AMERICAN MACHINIST

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ENTERED AT POST OFFICE, NEW YORK, AS SECOND CLASS MATTER.

New Twenty-Inch Swing Engine Lathe.

Our engraving of a 20″ swing engine lathe represents one just brought out by E. W. Bliss, Brooklyn, N. Y., and which possesses some features we believe worthy of notice. The building of a number of these lathes was commenced some months since by Mr. Bliss, the intention being to manufacture several to be used in his own works on press and die work. For this purpose the lathe is made throughout of great weight and strength, and, since much of the work in this class of machinery is done in the chuck or from the face plate, the spindle, which is of tool steel, is large in diameter, and the front bearing has a length of 4½″, while the distance between the two journals is extended to give steadiness, and to afford room for a cone pulley adapted to use a wide belt. The journals are lapped, and the boxes are of the best bronze—tin and copper—accurately scraped to the journals.

It will be seen that this is what is known as a "weighted lathe," that is, a weight is used instead of gibs to keep the slide down to the ways. Recognizing that the pressure of the tool is in a direction to keep the front part of the slide against, and to lift the back part of it from the ways, this weight is placed behind and close to the back way, by which a much less amount of metal is sufficient. Ii is bolted firmly in place, and is of such form as to be quite out of the way and sightly in appearance.

As stated, the pressure of the tool is in a direction to keep the front part of the slide evenly along its length, down to the way, except in the instance of using a tool of a long overhang—as in boring a hole of considerable depth—when the tool is converted into a lever to lift the right hand corner of the slide. To provide against this, a short gib and set screw is used to hold this corner down.

The lathe is provided with both horizontal and cross feed, the former being arranged to work with a belt, and not by the nut and screw. The cross feed goes into use by a half turn of the hand knob; the gear, by which motion is transferred to the screw, being connected by a constant friction in such a way as to slip, should the tool be carelessly fed against a shoulder. It will from this be seen that while this feed is positive, so far as throwing it on and off is concerned, it yet possesses the advantages of a friction in permitting the parts to slip before the strain is sufficient to cause breakage of some of the pieces. Altogether, the feed, both horizontal and cross, is simple in the arrangement of its parts, and effective and strong in its operation.

The trusses shown under the bed are a novel feature. They were applied after it had been definitely determined by actual experiment that the bed of a lathe, even when made as heavy as this one, would spring when resting on two legs, to an extent that was readily measurable.

They extend from the ends of the lathe, and the struts at the center are provided with adjusting nuts (which in the engraving are hidden by other projecting parts), and which can be adjusted to give exactly the strain necessary to correct the tendency of the bed to sag.

This lathe is designed for cutting screws with only one belt, for which the arrangement that will be described is provided. The leading screw has five threads to the inch, and the nut is made with halves to lock with a lever device. Of course, any thread that is a multiple of the leading screw, such as five, ten, fifteen, &c , may be cut by simply unlocking the nut, moving the slide back and locking the nut again. For cutting other threads than these, the following device—the invention of the foreman in one of the departments—is employed: Upon one end of a short arbor adapted to run in a box at the right side and behind the apron, is a small worm wheel of fifteen teeth, which is arranged to be engaged or disengaged with the leading screw. Upon the other end of this arbor is a small circular disc, in which are three equidistant notches, one edge or boundary of each of which is a radial line, while a portion of the other boundary is sloping or cam shaped. In closing the nut upon the screw, a projecting pin enters one of these notches, this being the only condition under which it is possible to close it; the pin at all other times than when opposite one of these notches, coming in contact with the periphery of the disc, thereby preventing the necessary motion.

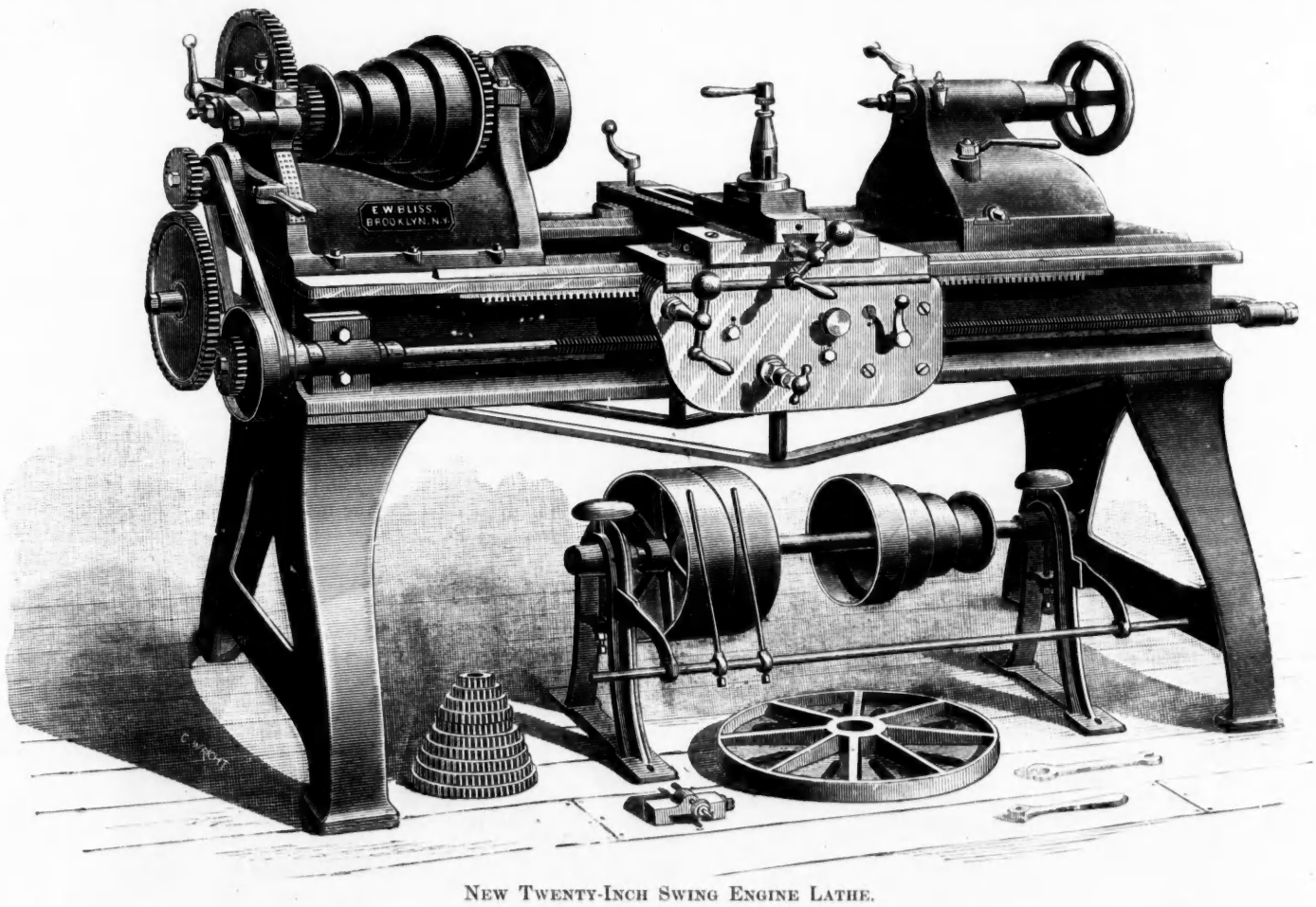
The number of teeth in the worm wheel (fifteen) divided by the number of notches in the disc, being equal to the number of threads to the inch of the leading screw, each of the three notches passing in their revolution any fixed point (as the pin previously referred to) will represent revolutions of the leading screw corresponding to one inch advance of the slide. In cutting screws this worm wheel is set in working contact with the screw, the motion of which will cause the disc to revolve, except when this tendency is neutralized by the motion of the slide; hence it is only necessary in using this device to unlock the nut, move the slide back to the position for starting again, bring the pin by the motion of the lever to bear against the periphery of the disc, and when the screw has revolved the disc so as to bring one of the notches against it, the nut will close with the tool in the proper position with reference to the thread being cut.

The apparatus is very simple and allows of the cutting of any thread, the number to the inch of which is represented by a whole number. The cam-shaped edge or boundary lines of one side of the notches is for the purpose of allowing the pin to enter the notch easily, and to indicate by the yielding of the lever to the pressure of the hand when approaching it.

This arrangement incidentally provides a means of preventing the nut from being accidentally locked to the screw while the lathe is being worked with the regular feed; since by moving the worm wheel out of gear with the screw, any attempt to lock the nut would bring the pin into contact with the periphery of the wheel, as previously explained.

While no attempt is made at extra finish, such parts as are usually finished are well done, and the machine, as a whole, presents a general neat appearance and one that will bear close inspection as to strength and workmanship. They are made, we understand, of different lengths of bed as required, and are complete with countershaft and hangers, wrenches, &c.

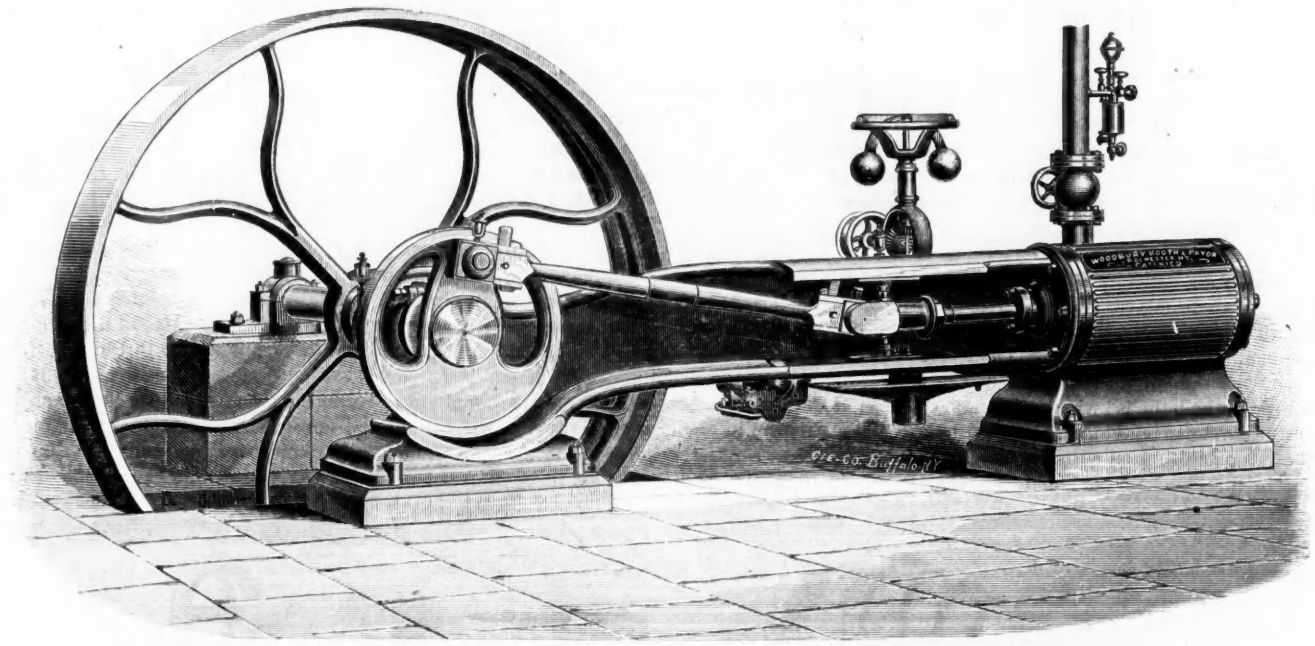
Six of these lathes are already in use at the works of Mr. Bliss, Plymouth, Pearl and John streets, Brooklyn, N. Y., and six more will soon be added.



NEW TWENTY-INCH SWING ENGINE LATHE.

Improved Automatic Steam Engine.

We present this week two views of the Woodbury, Booth & Pryor improved automatic cut-off engine. This engine was illustrated and described in our issue of March, 1879, at which time the distinctive features of the arrangement of valves, etc., were fully explained. Since then, however, the entire set of patterns has been thoroughly revised and various improvements have from time to time been added. The distinguishing features have been preserved, such as steam distribution by a valve made in one piece and driven by a simple eccentric motion, and suppression by a supplemental cut-off valve, operated over diagonal ports immediately over the back of the main slide, etc. In other respects the engine has been materially changed, the parts having been strengthened, where experience has shown the advisability of doing so, and the general appearance of the engine much improved. An automatic oiler, for the under slide, has been devised, which is said to work in a very satisfactory manner, doing away entirely with any difficulty in this respect. This is of considerable importance, since in all engines with girder frames, as usually run, the pressure is on the lower slide, and however ample the wearing surface, unless it is properly lubricated, there will be trouble.

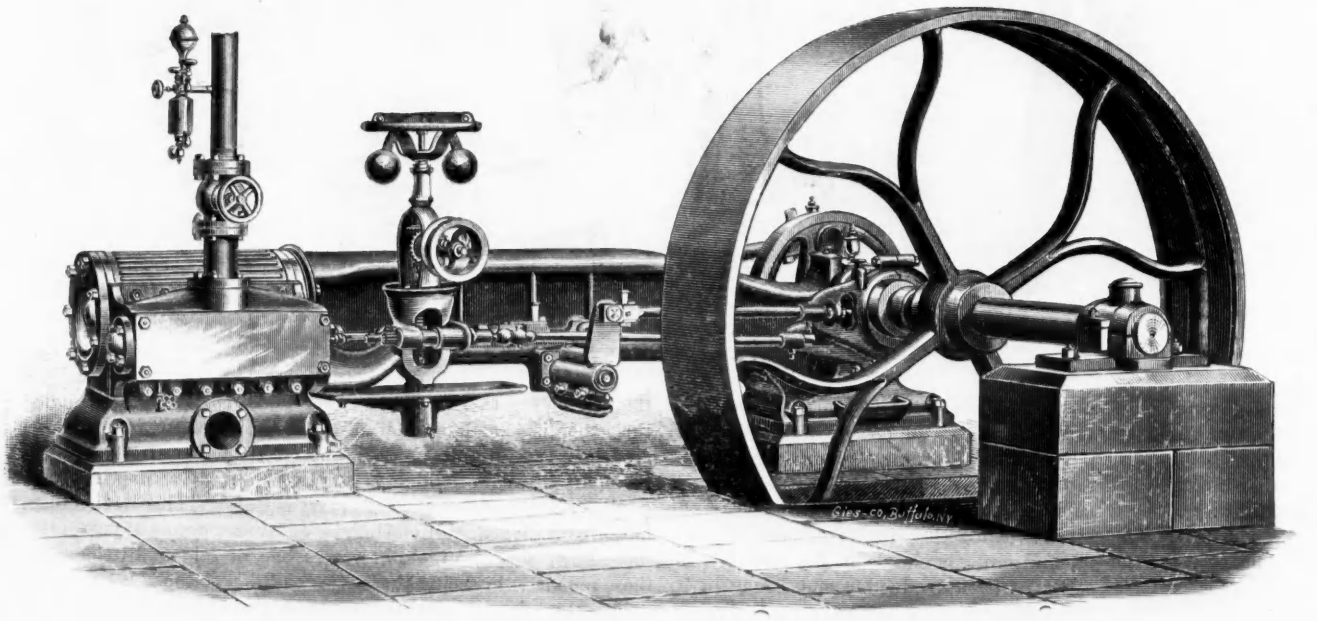


Front View of Engine.

Another novelty is the use of a hollow crank pin, so constructed as to be filled—by unscrewing a cup with the thumb and finger—with tallow or other lubricating substance, which will remain in an unmelted condition, except in the event of the pin becoming heated, when it will be discharged upon the bearing surfaces.

It is claimed that this engine, as at present constructed, presents great simplicity of detail, particularly with reference to the valves and valve gear, both main and cut-off, and a correct distribution of metal to provide the necessary strength, together with ample wearing surfaces.

They are made by Woodbury, Booth & Pryor, Rochester, N. Y.



Back View of Engine.

A recent English invention, relating to furnaces for steam generators, consists of a double bridge wall, the space between the two walls being spanned by grated plates, covered with loose fire-brick or other material. Underneath this is a second grating, the openings through which are controlled by a correspondingly grated valve. The operation of this is said to be, that the covering of the upper grating becomes intensely heated by the fire, when it is clear, and each time the furnace is charged with fresh coal, air is admitted through the grated valve, and passing up through this covering, absorbs the heat. The valve is connected to the door so as to be opened with it and is closed gradually, thus furnishing hot air at the time when it is needed, to prevent smoke.

Atlantic Cotton Exposition.

Origin of the Exposition.—Comprehensive Character of the Exhibits.—The place to learn what the South wants in Machinery.—The Buildings and how to reach them—Making a Suit of Clothes on Schedule time.

Atlanta, Ga., Nov. 9, 1881.

Editor American Machinist:

Cotton well carded is half spun, says the old apothegm; but the experience of later years would fix the critical point at the manner in which it was delivered to the mill, rather than the skill with which the carder performed his important task. For a long time the dissatisfaction with the condition in which cotton reached the northern mills found vent at the meetings of the New England Cotton Manufacturers' Association, in resolutions or reports of committees. When this subject was under consideration at the meeting held in the Spring of 1880, Mr. Edward Atkinson stated that the solution of these difficulties must be applied by the cotton planter, where the cotton was raised, and from motives which would directly accrue to the planter's benefit. A few days later this idea was expressed in greater detail in a letter which Mr. Atkinson wrote to the *New York Herald*, suggesting that the planters hold a fair in some Southern city where the different varieties of cotton staple could be compared with each other, methods of cultivation, ginning and packing, shown and discussed. Such an exhibition would also be open to the manufacturer, so that the cotton spinner and producer could meet face to face, and both parties reap those advantages arising from that acquaintance and mutual understanding, which is beneficial in all commercial transactions. The general response in favor of such an undertaking showed that the time was ripe for such a work.

At the request of leading citizens of the State, Mr. Atkinson delivered an address on the subject in Atlanta in the Autumn of 1880, and that city immediately took the initiative and started the Exhibition, which opened on the 5th of last October. It was a matter of such good fortune as to constitute an element of success, that Hon. H. I. Kimball of Atlanta early took a leading part in the enterprise. He is a citizen of Atlanta, identified with its prosperity, a man of affairs trained by extensive business experience, with wisdom to plan and vigor to execute, he has pushed the matter through difficulties insurmountable to most men.

Surrounded by able assistance, he has rendered the exhibition a success in everything pertaining to the objects for which it was started.

The exhibition is not merely a show of cotton, but presents everything relating to the raising of cotton, wool, silk, hemp and jute; its cultivation, preparation for the market, methods of manufacture, and the finished goods.

In the matter of cultivation, we see the fertilizers, seeds, implements for planting and gathering the crop, as well as numerous specimens of growth. In certain portions of the exhibition grounds are plots of cotton, ramie, hemp, sugar and other Southern products. In pens are sheep, Angora goats and cattle.

The preparation for the market is shown by the methods of ginning and packing. The latest machines for hulling, grinding and pressing cotton seed show methods of utilizing this portion of the cotton crop, which in most instances has hitherto been wasted.

The manufacture of textiles is shown by the machinery exhibited by all the leading makers; and the principal mills in the country, both North and South, have contributed specimens of their goods.

In a large annex, the railways of the southern belt have an independent exhibit of the mineral and agricultural resources of the country through which their lines extend. The details of these various classes will be treated in subsequent letters. This is the first truly American exhibition exceeding the limits of a local agricultural fair ever held in America.

The only foreign exhibit is the Macarthy Roller Cotton Gin, manufactured by Platt, of Oldham, England, who is represented by his Philadelphia agent.

For the first time the mechanic of the North has a chance to meet a number of Southern planters from the whole South, and learn face to face their real needs of machinery. No one at the North engaged in the manufacture of any machinery used in the South can afford to lose this chance, to avail himself of such an opportunity which this presents for him to meet present and future demands. A large party of Northern mill treasurers and agents have been here, and, on leaving, authorized the publication of a statement that they were going to send their superintendents and overseers down here, and as many of this party as are able will return in December.*

For the extent of the exhibition listen to the logic of numbers.

The main building is in the form of a Greek cross (an ideal cotton mill), 720 by 400 feet. The railway exhibit, 315 by 100 feet, with annex 50 by 60 feet; wagon and carriage house nearly as large. Art and Industrial building the same as the railway building, but three stories in height. The Judges' Hall is a large building, containing the executive offices and a hall seating 2,500. Jones & Co.'s restaurant and Department of Public Comfort are large buildings. There are now 28 buildings, not including buildings devoted to separate exhibits, with 21 acres of floor space, over 11 miles of aisles, and over 2,000 exhibitors.

The exhibition is held in Oglethorpe Park, a tract of 200 acres, two miles from the center of the city.

Quarter-hour special trains serve the traveling public with quick transit, also street cars and omnibus lines.

To reach Atlanta, the through train leaves New York by the Pennsylvania Railroad at nine in the evening. This is provided with sleepers, and arrangements for meals are satisfactory. Leaving New York one evening, the train reaches Atlanta over the Piedmont Air Line at noon the next day but one. Some prefer to leave New York on the ten

o'clock morning train, reaching Richmond in the evening, stopping over there and taking the through train at noon the next day. The hotels here are the Exposition, near the grounds, and the Markham and the Kimball in the city. For most persons it is preferable to board in the private families who have hospitably opened their doors for this purpose for the accommodation of the Northern visitors.

This department of the exposition is under the charge of C. J. Kimball, of Atlanta, who gives his services freely to the arrangement of boarding places for strangers. A letter written to him, stating what time the individual or party wish to remain, will receive immediate attention.

A suit of clothes was made in a hurry for Mr. Edward Atkinson this week. The seed cotton was ginned on Horne's anti-friction gin at 8.45 A. M; Picker, of Kitson Machine Co., at 9.03 A. M.; Card of Foss & Peavey at 9.19 A. M.; Slubber, of City Machine Co., at 10.05 A. M.; spun on Fales & Jenks new Rabbeth frame at10.20 A.M.; wove on a Crompton loom at 10.53 A. M. Taken to dye house exhibit of N. Spencer Thomas at 12.45 P. M., and dyed with his one dip dye number 44, a jet black color. An Atlanta tailor measured Mr. Atkinson while the goods were being woven, and at 2.05 P. M. the finished cloth was cut by him and sewed together on the Wheeler & Wilson machines at their exhibit. The suit was finished at 6.15 P.M., and it would have been delivered earlier if the atmosphere had not been so unfavorable. It was a damp, muggy day, temperature 60 degrees, humidity 61 per cent.

The cloth was made at the exhibit of the Willimantic Thread Co., to which a more extended reference will be made in a subsequent letter.

The lining of the sleeves was of satin, and of the vest white brocade silk, made by Cheney Brothers, in Connecticut, and contributed by their representative, Mr. Julius Pinney.

One dry old fellow inquires if this is to mark a new era for the mendacious promises which the ninth part of a man holds out to impatient customers of "some time next week, or week after," and he wishes to know if we shall have agreements for delivery of garments made on split second time, and *lived up to*.

We fear that such a time is only a barren ideality, and, as of yore, the only way known among men to have a suit of clothes made promptly is to kick up a fuss, which will entitle the bearer to one at the expense and protection of the State.

C. J. H. WOODBURY.

*The following letter written by Edward Atkinson appeared in the *Atlanta Constitution*, Nov. 9th.

Having come to Atlanta at the head of a party of the ablest of the cotton manufacturers of the north, I find myself placed in a position of undue prominence, which is somewhat embarrassing, but I must fulfill the duty which this incident has imposed upon me, before I leave your pleasant and hospitable city.

On their behalf and at their request let me first present an apology for them and for myself, for not acknowledging in a more personal way the kind hospitality which we have received. The busy duties of attending the exhibition and studying its lessons have fully absorbed our time.

In respect to the exhibition we beg to say that its importance and its far reaching benefits have grown upon us day by day. We have had only such a conception of the resources and productive power of this great southern land as can be had from far distant observation and hearsay, but now we have been brought face to face with its visible and tangible evidences.

We return home, determined to send here on the 6th of December, to meet the national association of cotton planters, as many of our manufacturers as we can induce to come, and we do not feel that it will be difficult to send a very large delegation when we make our report.

Many of my friends who have already returned have also determined to send here the overseers and master mechanics from the mills under their charge. I did not mention to them the danger they would incur, and it would not be wise for you to mention it, but I may use the privilege of a Yankee in guessing that some of these master mechanics will return here again, "bringing their trunks to stay," if they see the opportunity which exists in working up the timber, the mineral, the tanning material, etc., which are exhibited in such profuse abundance, as we have seen it. I guess some of them will stay.

Let me take this opportunity to render to one man the meed of praise and credit which is his due. We have wondered at the vigor and energy displayed in the construction of these buildings and bringing order out of the apparent chaos which was reported to us just before the opening. I have myself been almost humiliated by being put forward as the originator of this work. Any man can use a pen and propose a plan. Any man can employ a draughtsman to put the plan in shape, but it always takes one man to do the work.

The citizens of Atlanta have well sustained the one man who could develop the little germ and create the great fact. To them be a full measure of praise and credit. But even your zeal and judgment might not have been effective if there had not been among your number the one man who could accomplish the work.

When all our names are forgotten his name will still be remembered, and will be completely indentified with the greatest event in the industrial history of the country.

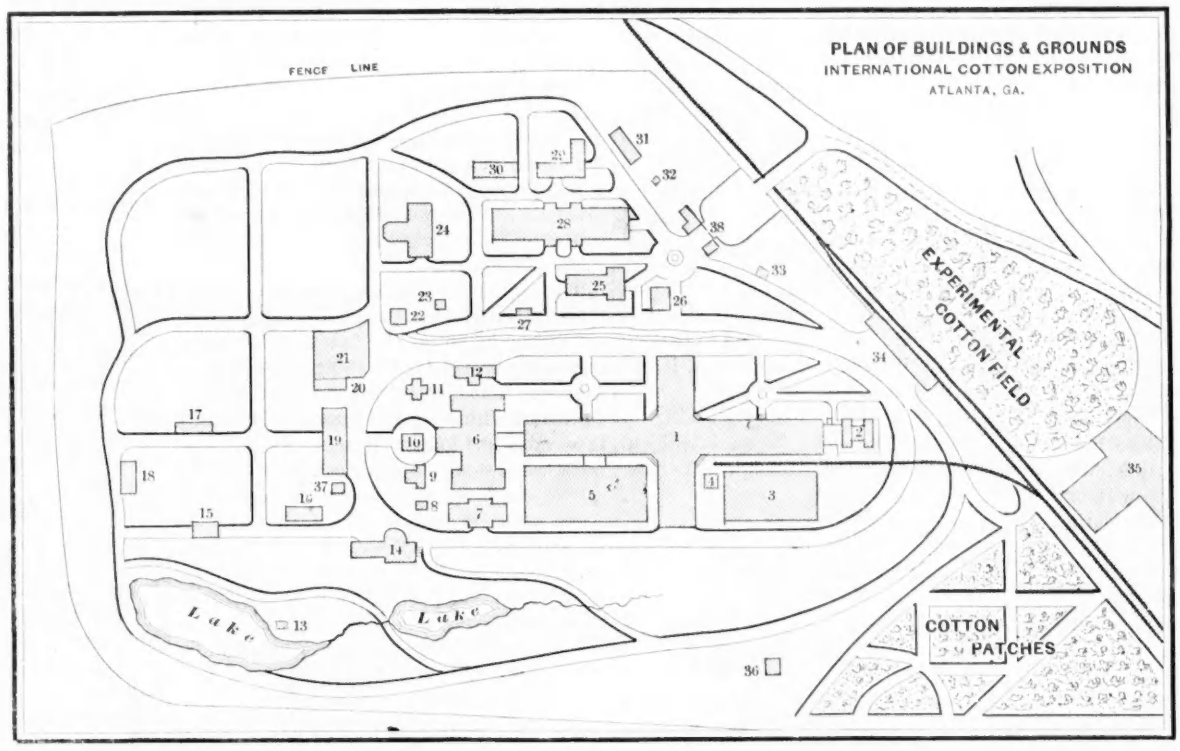
THE INTERNATIONAL COTTON EXHIBITION AT ATLANTA.

We are so well satisfied of this that we have written to our friends in Boston advising them that if the proposed world's fair presently reaches the stage of practical organization and work, they had better borrow H. I. Kimball from Atlanta and constitute him their director general.

On this page we publish a plan of the Atlanta Exposition Buildings, for the original of which we are indebted to the architects, Fay & Eichberg, of that city.

The following designations will readily be understood by reference to the cut.

1.—Main Building.
2.—Department Public Comfort.
3.—Agricultural Building.
4.—Boilers.
5.—Carriage Building.
6.—Department Minerals and Woods.
7.— " " " Annex.
8.—Turpentine Still.
9 and 10.—Special Exhibits Agricul. Mach.
11.—Georgia Chemical Works Building.
12.—Willimantic Thread Co. Building.
13.—Pump House.
14.—Restaurant.
15.—Dye House.
16 and 17.—Saw Mills.
18.—Manure Machine.
19.—Ampitheater.
20.—Press Pavilion,
21.—Seeds Exhibit Building.
22.—Chemical Building.
23, 32, and 37—Wind Mills.
24.—Florida Building.
25.—Judges' Hall.
26 and 27.—Music Pavilion.
28.—Department Art and Industry.
29.—Bar Room.
30.—Tennessee Mineral Building.
31.—Special Exhibit Buggies, &c.
33.—Police Headquarters.
34.—Entrances, W. & A. R. R. Depot.
35.—Exposition Hotel.
36.—Ensilage Building.
38—Entrances Street Cars.
Heavy crossed lines represent R. R.
- - - - - - - - represents Street Car Line.



Shop Kinks.

No. 21.

By L. F. LYNE.

A USEFUL TOOL FOR SLOTTING MACHINES.

Every one who has had anything to do with slotting machines well knows the difficulties attending the use of tools made of single pieces of steel. For instance, in feeding a tool in one direction, the work is moved ahead, while the tool is at its highest position, but while feeding in the opposite direction, the work is moved ahead while the tool is at its lowest position. The latter causes the tool to be dragged back over the work with tremendous force, causing it to spring and wear the cutting edge away very rapidly at each stroke. If the tool is at all brittle the edge will be fractured by this treatment, so as to greatly interfere with the production of first-class work. The fact is, that, in either of the former cases, it is impossible to make a true surface with a dull tool, upon a slotting machine.

Tools upon all reciprocating machines, embodying the principles of the planer for cutting in but one direction, should be provided with suitable means for allowing the tool to yield to the pressure brought upon it in drawing it back over the work, so that the resistance offered may be but little and the cutting edge of the tool subjected to the least possible wear.

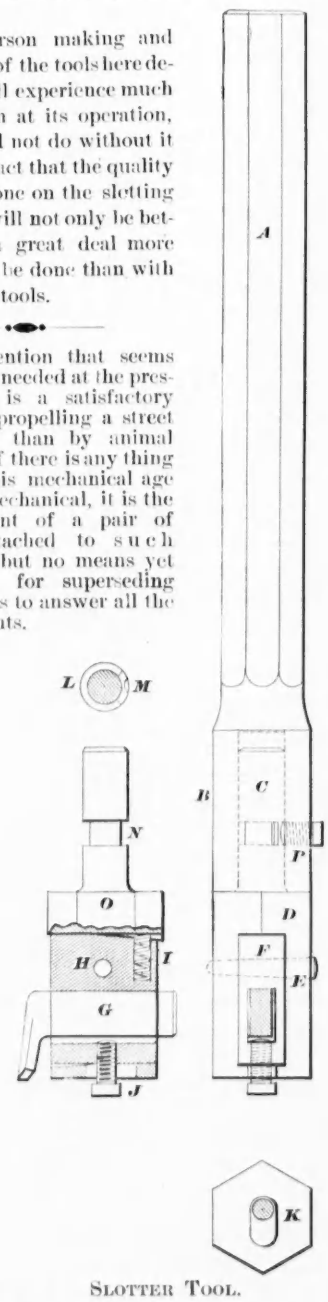
A tool to accomplish this end is shown in the accompanying engraving. The first one I ever saw of this kind was made by an aged English mechanic named Jones. Whether he was the original inventor or not I cannot say, but I do know that this tool has not been used as extensively as it might be with advantage. It will save money expended in solid steel tools, in which but a small part of the material required is available for use.

The tool here represented for general work consists of a shank or body *A*, made from a bar of 1¼" octagon steel. One end of this bar *B*, is rounded up, and bored out to a diameter of 1" and 3" in depth. A head *D*, is made of hexagon shape, 2⅛" across the flat. One end *C*, of this head is turned to fit the hole neatly in the body, and is securely held in any desired position by a set screw *P*. To prevent this set screw from digging into the bottom of the groove, a die is placed under it, as shown at *M*, *L* represening a section of the end of head at *N*. The cutting tool *G*, is held by being placed in a mortise through the holder *F H*, and tightening the set screw *J*, as shown very clearly in the section *O*. The tool holder is pivoted and allowed to move upon the tapered steel pin *E*.

It will be noticed that, in drawing the tool upward over a rough casting, the edge will be pressed away from the work as in the case of the tool upon a planer, and, when it has cleared the top, the tool will be returned to its original position by a spiral steel spring placed in a hole at *I*. The edge of the tool holder is cut away at *I*, and the bottom of the mortise in the head nearest the edge of the tool, to allow the holder to tip during the upward movement of the tool. When the tool returns to its original position, and is ready to begin its downward stroke, it is strongly supported by the holder bearing upon the top and bottom of mortise at opposite sides in the head, as shown. The head *D* has an oval mortise through the end, as shown at *K*, to allow free motion of the set screw *J*.

The proportions of this tool may be varied to suit special kinds of work, and by its use equally good and accurate work may be done upon a slotting machine as upon a planer. The cutting tools required for this sized tool are made of ½"×1" steel; therefore, being small, they should be of the very best tool steel.

Any person making and using one of the tools here described will experience much satisfaction at its operation, and would not do without it from the fact that the quality of work done on the slotting machine will not only be better, but a great deal more work may be done than with solid steel tools.



SLOTTER TOOL.

An invention that seems peculiarly needed at the present time, is a satisfactory means of propelling a street car other than by animal power. If there is any thing that in this mechanical age looks unmechanical, it is the arrangement of a pair of horses attached to such carriages, but no means yet devised for superseding them seems to answer all the requirements.

A lad whose days were given to investigating machinery in a woolen mill, being called upon at an evening school to define lubricant, replied: "Something that makes the machines go hard when you don't put it on."

Finishing Green Sand Moulds.

BY THOS. D. WEST.

Go into any machine or jobbing foundry, and notice moulders finishing or patching moulds that have been broken in drawing the pattern, and you will see some one mending a corner, for instance, that has been started or broken, by taking his swab and wetting the part to be patched, and then taking some sand and pressing it on the top of the wetted part. Another moulder, not having so large a piece to mend, will swab the part, and then patch on sand with his trowel; or he may be finishing a cope overhead, when ten chances to one he will be raising his trowel for rubbing sand into the holes, and every time the trowel goes with a bit of sand it is sleeked up against the smooth surface, caused by the pressure and sliding movement of the trowel. Although he will see the sand falling down, as fast almost as he puts it up, he will keep on trying until he thinks something is the matter, then he will tell his helper to get him some nails; that the sand is so rotten and poor it will not hold together.

He will then push up some nails to hold the sand. Nails are a useful article, but some moulders will make a casting without using one, while another, in making the same casting, will use two or three pounds, and, perhaps, if he did not use them his casting would not be good. Some moulders will ram up a mould in such a manner that it will not require half the finishing it would require if rammed up by another.

If a moulder thinks he has more time to finish the mould than he has to ram it up, he will hurry or slight the ramming; or he will do this, perhaps, in order to catch the use of the crane, or to get ahead of some moulder on the gager pile, etc. As there are plenty of nails in the kegs, he will whisper to himself that he will not bother putting a rod in that corner, or be particular in ramming it; for if the pattern when drawn starts or knocks off the corner, he will have plenty of time to patch and nail it Or he may ram, rod and vent the bottom in a creditable manner, and slight the cope, by not tucking the bars good, or ramming up the sand solid, and when the cope is lifted off, and a large lump of sand falls out, he will think of the nail keg and smile. Should the foreman complain about using so many nails he will tell him that the crane jumped, or that the old wooden flask had ought to have been broken up long ago, and if times are good and men scarce, the foreman, to avoid any words, will walk away, and in a short time he will order the nail kegs to be locked up and carry the key in his pocket.

About the first thing a moulder should do after his cope is lifted off—when the pattern is bedded in the floor—is to lay some boards around on his joint so as to preserve it, as there is nothing that looks so slovenly as to see the joints of moulds all tramped and cut up by kneeling on them when finishing..

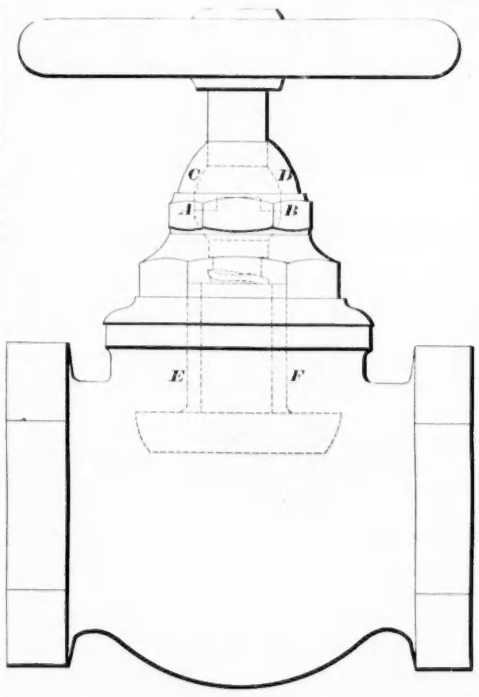
In drawing out a pattern, the top edge of the mould is always started more or less, and it is the first part that the moulder should give his attention to, by getting it sleeked or fastened down to its original place. In finishing over the mould, if there are any parts that look started, it is best, if practicable, to tear them off instead of just pressing the sand back—even if there are some nails in it—and then rebuild or patch it up, not with sand on the trowel, but by using the hands to press the sand with. By using the hands a moulder can unite and shape the soft loose sand on the solid sand in a shorter time and in a great deal more reliable manner than by patching it on with a trowel. How much more mechanical it looks to see a moulder, when mending a cope overhead, take the sand in his hand instead of on the point of a trowel.

When the parts are made solid take a little wooden straight edge, shape and smooth off the extra sand, and go lightly over with the trowel or finishing tools. In patching on sand a moulder's fingers never caused a cold shut or scabby casting; but too much sleeking with tools often does so. In such castings as thin pipes or plates, it is better to have the fingers go easily over the sleeked or finished mould, and then rough the surface up a little, as iron will lay quietly on a rough surface, when it would boil or bubble against a smooth, sleeked surface.

If any part of a mould to be mended is too dry for the sand to stick to, dampen it by taking a mouthful of water and blowing it out in a fine spray. When water is swabbed on an extra dampness, or mud is formed, so that when the hot iron is poured into the mould, although it may have surface sand the right temperature to lay on; as this surface gets heated, the heat soon reaches this extra dampness or mud, and, as heat, when it comes in contact with dampness is sure to raise steam, and the sand not being of a body strong enough to hold the pressure, it will escape by lifting the sand on top of it and passing up through the iron will cause it to bubble, and cause the casting to blow.

If the swab is used it should only be on the surface, for then, when the steam is made, it has only to raise the iron to pass up through, and, if there is a scab on it, it will be a very light one.

For heavy or light casting sleeking or swabbing must be done in an intelligent manner, if good castings are expected.



A Self-Packing Valve.

BY H. F. J. PORTER.

A PAPER READ BEFORE THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS.

I have deemed it almost a duty to present to the attention of the Society an improvement in the usual form of steam valve, which, as far as the packing is concerned, brings it, in my opinion, almost, if not quite, to a state of perfection.

It will not be necessary to call to the attention of an engineer the constant source of annoyance and expense due to the leakage of steam about the stem of the present market valve. That this defect has received great consideration during the past few years is amply proven by the number of patents issued to the inventors of various kinds of packing, each claiming to be superior to all other combinations, and yet none accomplishing the desired result, namely, a permanently tight stem.

In factories and large buildings where steam is used, either as a motor or a heater, it has ever been an item of great expense and trouble to repack the valves and repair damages caused by leaking stems, amounting in many cases to more than the original cost of the valves in one year.

It was my fortune during the last summer to learn of a number of these self-packing valves, which had been in constant use in the works and mines of the Lehigh Line Co., Bethlehem, Pa., for the past two years.

Some of these were used as throttle valves on various rock drills, and these received probably as thorough a test as could have been given them, being constantly under the hand of the engineer. The latter, however, on being questioned as to their action, replied that they had never wept a drop.

Such being the case, it is indeed time to call the attention of this Society to its construction, that they may pass judgment upon its merits, as well as its defects.

In external appearance, as seen from the sketch, it does not differ materially from the present market valve, except that it is possibly a little more compact. Its beauty of design lies in the internal arrangement, which is such as to entirely dispense with packing of any description.

A short explanation of the sketch will lay the matter before you.

As seen from the dotted lines, the stem is divided at the line *A B*, and the two parts connected by a device similar to an ordinary clutch coupling.

The interior of this coupling is a hollow cylinder, in which is placed a common helical spring, having for its function the keeping of the ball valve (*C D*) upon its seat in the cap. The lower portion of the stem is furnished with a square thread, whose duty is to raise and lower the main valve. The main valve stem is cylindrical, with two V lugs upon it, moving in corresponding V ways in the fitting. These ways allow the valve sufficient motion to always find its seat properly, and yet prevents any turning upon the seat, and thus alleviating the cutting and tearing, so common in ordinary valves when grit or iron rust sticks upon the seat.

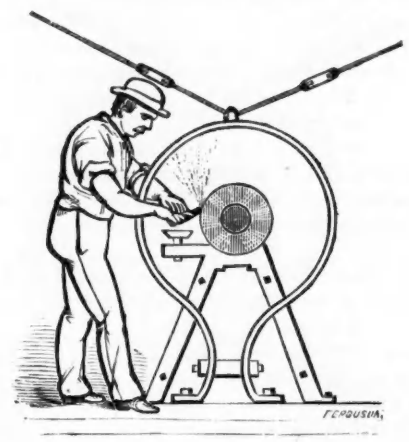
I have taken pains to inquire, wherever I could find that these valves have been put to practical test, and find that they have gained universal sanction.

Considering the defects of the ordinary valve, and the fact that these are completely overcome by this self-packing valve, I feel sure that engineers in general will indorse this as an improvement in the present form of steam valve.

Perhaps one of the finest examples of mechanical accuracy is the watch. It is simply marvelous that a little instrument, subject to constant changes of position, oiled once in a year—or perhaps two—receiving its motion from a spring, and the whole contrivance subject to great fluctuations in temperature, should go on marking the time within a few seconds for a year. Or, to look at it another way, that the balance wheel, upon which the accuracy of motion depends, should, in making a hundred millions or more vibrations under the adverse conditions noted, have failed by only a trifling number to have made exactly what it should have done. The watch, perhaps, of all machines, is the finest example of what persistent effort in the direction of perfection may accomplish, and is worthy the consideration of the mechanic as an example of the adaptation of means to the end in view.

The New York Trade Schools, located on First Avenue, Sixty-seventh and Sixty-eighth Sts., opened Nov. 21st, for the purpose of giving practical instruction in plumbing, mechanical drawing, painting, and bricklaying. The courses embrace lectures and instructions for practice. C. F. Wingate, formerly editor of the *Sanitary Engineer*, is manager. The charges to students are very light.

According to the Ogdensburg N. Y. *Journal*, the old-fashioned "husking bee" is in danger of being rendered obsolete by the threshing machine. A practical farmer residing near that city tried the experiment of putting his corn through the threshing machine, stalks and all, with a very satisfactory result. The threshing cut the stalks fine, and produced forty-five bushels of shelled corn per acre. That farmer says: "I will never husk and shell another crop, but will send it all through the threshing machine."



Heaton's Safety Guard for Emery Wheels and Grindstones.

As is well known, many serious accidents occur from the bursting of emery wheels, often resulting in the loss of life or in seriously maiming the victim. It is equally true that such accidents are in almost—perhaps quite—all instances the result of careessness on the part of some one, usually the operator. Emery wheels burst from being run too fast; that is, faster than the manufacturer recommends; from being allowed to get grossly out of truth, and hence out of balance; from the shaft getting loose in the boxes, and from injudicious and rough treatment generally. However this may be, it is well known that men will be careless in this as in other respects, and that familiarity with dangers, so far from inducing carefulness, has quite the contrary effect.

The object of the device shown in connection with this, is to provide for the safety of the operator, so far as possible, notwithstanding his own or some other one's carelessness.

When an emery wheel bursts, the pieces will fly off in lines, exactly at right angles to the axis of the spindle, hence, if a protection is provided in these directions, that is of sufficient strength to resist the impact of the pieces thrown off, it follows that the operator, so far at least as receiving any serious accident is concerned, is safe.

As will be seen, this safety guard consists of an iron strap which nearly encircles the wheel, and which in width is about one-third greater than that of the wheel. This, it is claimed, is sufficient in every instance to afford the desired protection.

The turn-buckles at the top serve the purpose of strengthening the guard, holding it rigidly in place, and by loosening the ground bolts, unscrewing one of the turn-buckles and screwing up the other, the guard may be always kept at the proper distance from the wheel to suit the workman; in this respect providing for the wear of the wheel.

These safety guards are designed for use with grindstones as well as with emery wheels, and are manufactured by the Heaton Emery Works, Albany, N. Y.

A New Steam Engine Governor.

We present on page 5 three engravings of a new Steam Engine Governor, manufactured by Wright & Hastings, Worcester, Mass. Fig. 1 represents the governor as arranged to be placed vertically; Fig. 2 shows it as made when used horizontally, and Fig. 3 is a longitudinal section.

It will be seen that the governor consists of the usual valve chamber, which is not shown in section. On the top of this chamber is bolted the frame to which the parts of the governor proper are attached. This frame is especially constructed with reference to allowing free access to the stuffing box and bolts, and to it the bracket that carries the driving pulley and actuating gear with their shaft, is bolted.

There is also held in position in this frame by a set screw, a hollow stud or sleeve, to which is attached the top of the governor, which by the operation of the miter gears is made to revolve around it. The casting forming the governor top is provided with ears to receive the arms, to which are

attached the balls, so that the whole revolves together in a manner common to such devices. In the interior of this stud or sleeve is placed a long, stiff spring, upon the top of which rests the piece *B*, to which the spindle is attached, and from which it passes down through the spring and stuffing box to the valve in the valve case.

The arms of the governor balls are so fashioned that their extreme ends rest and revolve on a hardened steel disc, which is interposed between them and the top of the piece *B*. This piece is free to move longitudinally in the sleeve.

So far as described, this arrangement only provides for running the engine at a definite speed, which would with any combination of parts be difficult to exactly predetermine. In order, however, that no difficulty shall be experienced from this the following device is employed :

By reference to the sectional engraving (Fig. 3) it will be seen that the lower end of the spring rests in the bottom of a hollow thimble, which is adapted to be moved in the lower end of the central sleeve by means of the screw A. By this means the tension of the spring can be changed at will, and any change in the tension calls for a corresponding change in the position of the governor balls and a different speed of the engine. It is said that in this way a variation in speed of the engine equal to 300 per cent. is almost instantly attainable.

From the foregoing it will be seen that the valve is operated upon by two forces; that of the spring always tending to move it in one direction, and that of the centrifugal force of the revolving balls tending to move it in a contrary direction. The first of these forces, or that of the spring, tends to open, and the second, or centrifugal force, tends to close it. If these two forces were for all positions of the balls and spring exactly equal, the governor would be isochronal in its action, the least variation in speed operating to entirely open or close the valve. In practice this would not do, so the spring is made of such length and strength as to vary in its resistance as compared to the centrifugal force, to such an extent as to keep the governor steady in its action and at the same time up to the limit of sensitiveness necessary for close regulation.

The balls are light, and run at a moderately high speed; thereby increasing the sensitiveness of the governor to very slight variations in speed, while all the parts are accurately fitted, and the end-bearing surfaces are provided with steel and rawhide washers.

The automatic stop-motion provides for instantly closing the valve in case of the breaking of the governor belt.

The valve is of large area, exactly balanced, and having but slight motion is subject to but little wear. As may be seen from a consideration of the construction and arrangement of the parts, no lost motion to affect the working of the governor can result from wear, since whatever of this there may be is always taken up in one direction, leaving it in a condition to act on the valve instantaneously.

It is claimed for this governor that it will work equally well in any position—the horizontal style being used in an upright position if desired—and that it is as nearly a perfect governor as it is practicable to make.

In 1390 some friars in Switzerland wished to build a windmill to save the labor of grinding corn by hand; but a neighboring landowner, who had bought the country around, forbade them, because, he said, he owned the winds. The bishop was appealed to, who said that winds belonged to the church and could not be used.—*The Milling World.*

A movement is on foot looking to the getting up of an exhibition of patents, models, etc., at Madrid. This exhibition, should its originators succeed in their efforts, will be similar in its scope to the one held at Frankfort on-the-Main, and which was quite fully described in an illustrated article in the AMERICAN MACHINIST of Oct. 1, 1881.

LETTERS FROM PRACTICAL MEN.

Hardening Steel.

Editor American Machinist :

While the too-carelessly written letter of mine appearing in your issue of November 19th is, in the main, an expression of my convictions growing out of experience and observation, I wish to disclaim any intention of saying "that *all* men experienced in hardening steel have been mistaken." My intention was to say that *all* those who believed that the peculiarly tough, fine condition in which steel can be put by hardening at the *proper heat* depended upon the use of any particular *compound* were "mistaken."

Again, I read, "The maximum steel to harden at the same heat of that of maximum temper," which should read, "The maximum steel to harden at the same heat of minimum temper."

The proper heat at which to harden steel can only be determined by the effect produced, and condition of the steel after hardening. Said a tool dresser at an establishment where tons of steel are used for tools, "That piece of steel was not too hot." The occasion of this assertion, which was made with much emphasis, was the examination of a piece of $\frac{5}{8}$" round steel, which had been hardened by the tool dresser at the request of the writer, and broken by a slight tap of the hammer. The grain, as shown by the fracture, was very coarse. The force required to break off the piece I held in my hand was so little as to suggest that it would be unsafe to drop a piece in the same condition on the floor. I at once proceeded to harden the other end of the same bar, and then requested the self-reliant steel worker, who *knew* by the color what heat was *right*, to break off a short piece by placing it over the corner of the anvil and tapping it with his hammer. Said he, after some dozen blows had failed to break it, "Of course I can't break it without nicking it. This steel is not hardened ; I knew it would not harden at that heat. It was hardly red." Testing it with a file showed that the piece was extremely hard. A heavier blow—in fact, nearly the heaviest which I could strike with the ordinary-sized forger's hammer—broke the piece, disclosing a grain ten times finer, mayhap one hundred times finer than in the piece first hardened. Still (although the tool dresser, in his attempt not to "back down," said it was "strong and fine, because it was not hardened)," this piece was sufficiently hard to cut glass like a diamond. By breaking the bar where it was not hardened, comparison showed a grain in the hardened piece much finer than in the unhardened bar.

S. W. GOODYEAR.

Waterbury, Conn.

Hardening in Liquids and Compounds—Two Sides to the Question—Both Sides Right.

Editor American Machinist :

There is no question discussed through the columns of your journal which is of more importance to all mechanics than that of tempering the tools they use.

The tempering of the steel alone is not the question of greatest importance. It is, first, the selection of the quality best adapted for the purpose intended ; second, careful treatment in preventing overheating in the forging ; third, to see that in the heating for annealing the steel is not heated to a blistering white heat, as is often the case, and fourth, to heat for tempering in a clear, bright fire (charcoal is always preferable) to the lowest possible heat that the steel will harden at in the liquid used, and best suited to the use to which it is intended to be put.

All this care is needed to insure good results, therefore the forging and tempering of steel should not be intrusted (as in many instances it is) to an ignorant "crank," who has a hobby of his own.

"Percentage of carbon contained is one of the factors in determining quality." Yes, while the steel is in its commercial condition, but it would be hard to determine its quality by the amount of carbon contained after having passed into forgings, especially if welded on to iron, as in the case of dies or edged tools.

"Heating steel opens the grain just in proportion to the degree to which it is heated." True, and the nearer it reaches the melting point the closer it approaches its natural crystalline condition.

The higher steel becomes heated, after having passed a dark red, the nearer it approaches the crystalline condition of cast iron. This fact should be remembered by those who stubbornly persist in overheating, nor will any dose of resin, soap-suds, oil, tar, etc., restore it to its former state.

I agree with Mr. Goodyear that "the lowest possible heat compatible with the degree of hardness required is the best," but if the degree of hardness required cannot be obtained without overheating, there are chemicals which will render the steel very hard when heated and quenched at a dark red. I have found cyanide of potassium for small articles a great aid.

I also agree with "Flux," provided he applies his flux for the purpose all fluxes are intended to serve, that of covering or protecting the article from the injurious effects of the atmosphere, and of the sulphurous gasses absorbed from the coal. If "heating steel opens the grain just in proportion to the degree to which it is heated," it follows that while in this porous condition it absorbs all the injurious substances from the fire. It does not necessarily follow that the steel should be heated to the melting point before a flux of borax, brown soap, resin, cyanide of potassium, and others of a kindred character, would melt and flow. If it were possible to heat steel to the proper degree and temper it while in a vacuum ; the article so treated would retain its original brightness.

I have a theory of my own in relation to the phenomena of steel hardening when heated and quenched in cold liquids, which I will present at some future time, which may draw out some thoughts from your very able correspondents. T. F. HAGERTY.

San Francisco, Cal.

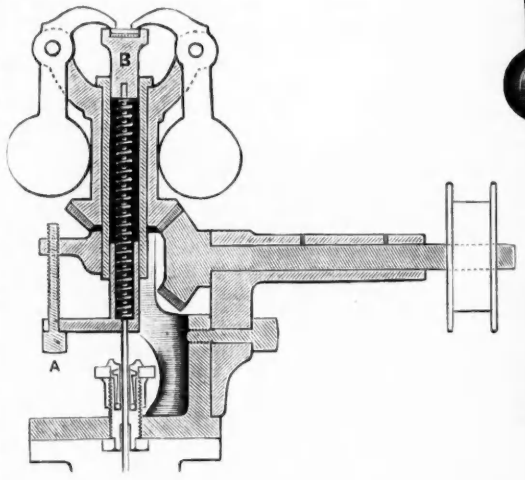


FIG. 3.—SECTION OF GOVERNOR..

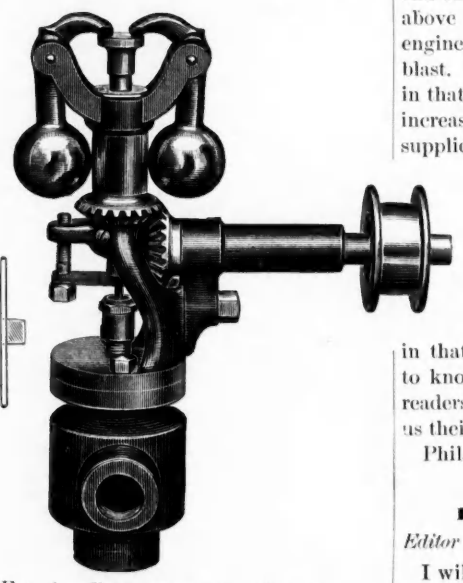


FIG. 1.—GOVERNOR USED VERTICALLY.

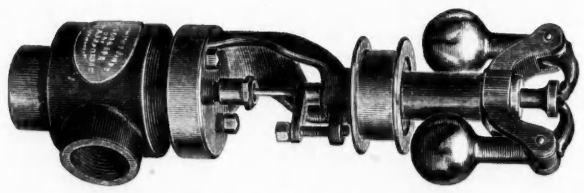


FIG. 2.—GOVERNOR USED HORIZONTALLY. (See Page 4.)

A Question Upon Chimney Draft.

Editor American Machinist :

In the shop where I am employed is a 10 H. P. upright engine. In order to increase the draft of his fire, the engineer has been using a 20" Sturtevant blower, running at 300 revolutions per minute, the blast entering under the grate. Last week, on making some repairs about the engine, the machinist who did the job, among other things removed the fan blast from under the grate and entered it in the smokestack about 8 ft. above the fire box. The exhaust from the engine enters the smokestack below the fan blast. Now, I claim that the blast applied in that manner is useless. That in order to increase the combustion, the air should be supplied under or to the fire. That the fan drives no more air up the smoke stack than it supplies itself, but tends rather to create a backward pressure, thus impeding what draft there *would be* were the fan not used. If I am in the wrong I would like to know it. If the fan blast applied in that way increases the draft, I would like to know *why*. Will some of the "Practical readers of the AMERICAN MACHINIST" give us their views on the subject?

Philadelphia, Pa. A. S. WHITCOMB.

Breaking Up Blocks of Iron.

Editor American Machinist :

I will tell J. H., of Cohoes, how to break up his big piece of cast iron. Drill a $1\frac{1}{4}$" hole in the center 30" deep, and put in a charge of dynamite 5" or 6" deep; tamp it down well, and explode it in the usual manner. This will probably do the work, but if it does not it will enlarge the diameter of the hole where the cartridge lay to $1\frac{1}{2}$" or 2", according to the porosity of the iron around it, so making room for a heavier charge.

If the first charge does not do the work put in another, filling the hole to the same depth as before, and tamping it down well, and this will break the block into four pieces, neither more nor less. A light charge of dynamite, judiciously placed in each of those pieces, will reduce them to a condition fit for the cupola.

It sometimes happens, from the choking of the tuyeres, or other causes, that the work in a large blast furnace will be stopped, and an irregular-shaped mass of iron, 3 or 4 feet in depth and 9 to 14 in diameter, will settle down in the bottom of the furnace and coo there, which would, in the old times, sometimes close down operations for several weeks. The former course was to take out all the front of the furnace, dig under and around the "salamander" (as it was called), jack it up, get it on rollers, and work it out into the yard.

Before the days of dynamite and similar "busters," the common course was to dig a hole in the ground and bury them out of sight, but now they are well worth breaking up, and this is done exactly in the way I have described above. Around old furnaces as many as half a dozen of these masses of iron, weighing from 90 to 130 tons, have been dug up and utilized within the last few years. Those who have become accustomed to this work do not now remove the salamander from the furnace to break it, but clean out a space of two or three inches between it and the wall, and break it where it lies.

They are able to judge so correctly of the

amount of dynamite required that, while they hardly ever fail to break it with the second charge, the pieces do not lie a quarter of an inch from each other, so there is no danger to the furnace.

The *Iron Age*, a few years ago, gave a very interesting account of this process. It is to it that I am mainly indebted for the information I now give. J. HODGSON.

Amherst, N. S.

Another Way to Break a Block of Iron.

Editor American Machinist:

I want to have a hand in breaking up that block of iron for our friend in Cohoes, and I believe it can be done without the shears and drop, as proposed by J. B. in your issue of November 19th.

My method would be to drill three rows of holes, even distances apart, three in each row, of 2″ diameter, 18″ deep; tap them 3″ deep; then about the last of December, say Christmas Eve, fill the holes with water up to the bottom of the threads; screw down a good fitting plug hard down upon the water. Be sure about that part of it. All you will have to do then will be to sit up nights, and pray for cold freezing weather—the colder the better.

I think, as J. B. says, that it will be pretty tough iron that can stand that kind of treatment without weakening. Confined water, when frozen, is irresistable.

FOUNDRYMAN FROM TOLEDO.

Rules that are Puzzling.

Editor American Machinist:

It is not often that I bother you with communications, but being bothered myself over the rules given by a so-called standard work (Haswell's) on the proportioning of slide valves, I feel like making others miserable. The first point the book in question starts out to explain is, "To compute how much lap must be given on the steam side of a slide-valve to cut off the steam at any given part of the stroke of the piston," which is exactly what I wanted to know, but the rule is what stuck me. It reads in this way: "From the length of stroke of piston subtract the length of stroke that is made before steam is cut off; divide the remainder by the stroke of the piston, and extract the square root of the quotient. Multiply this root by half the throw of the valve," &c.; but never mind the rest. What beats me is how one gets half the throw of the valve without knowing the lap, and since the determination of the proper lap for a given valve is the problem they start out with, what grounds have they for supposing one knows anything about the conditions that are to govern the rest of its proportions? Owing to my limited mathematical education, the fault may rest altogether with me, but if I hadn't made use of some suggestions in your issue of May 26th, current volume, I might still have been in the dark on that slide-valve question. Since I have dared to rise against "the powers that be," let me throw one more brick.

The example given for the application of this rule is, in part, as follows:

"Stroke, 60 inches; stroke of valve, 16 inches;" &c., till he reaches "Lead, 2 inches."

Now, was there ever an engine built that would run with a valve lead of two inches? If so, it must have run in the opposite direction from that intended. VALVE STEM.

Allegheny, Pa.

These are times of revolution and evolution with a vengeance. Things won't stay as our fathers put them, or even as we put them ourselves. Only the other day we were living in the age of iron, since which we have passed through the age of steel, and if we are to believe a part only of what is said, have just entered the age of paper. Paper boats, pails, barrels, crockery (?) ware, etc., etc., are too common to require comment, and now we are told that machinery of all kinds—particularly the cylinders of steam engines—can be made of paper, and that such products will be much more indestructible than when made of iron or steel. One "paper man" goes beyond this and proposes a paper diet—to replace "hash" probably.

Discussion of Mr. Root's Paper on "A New Method of Screw Propulsion."

BY THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS.

(Stenographically reported for the AMERICAN MACHINIST.)

MR. WOLFF.—The question of the effect of a screw propeller upon water is one upon which no definite theory has been based, or, as far as theory has been based, it can scarcely be ranked above hypothesis, since it has not been proved experimentally. It will probably be some time before any theory that can be framed will be able to be fully proved, because there are so many conditions entering into the question of screw propulsion. Mr. Root informs us that by his method of inclining the shaft he has obtained results which are superior to those obtained by the use of the ordinary form of screw. The fact that he has obtained these results by experiment entitles them at once to some consideration. Whether the theory that he has framed is correct or not, is a question, which, I think, cannot be answered properly in detail here, barring out the consideration of obtaining higher speed of vessel than the pitch of the screw into the number of revolutions, which is an impossibility. It will probably require considerable investigation in connection with the work that has been done by other writers on the subject, to see whether there are any errors in it or not. In listening to the hasty reading it will probably be difficult to catch that point.

On the question relative to the motion which the screw gives the water, which is the basis of Mr. Root's hypothesis as to the efficiency of the screw which he has obtained, I would like to refer to the upward action of the screw, which takes place in the line of shaft. Mr. Root has referred to that action as adding to the efficiency in raising the vessel and thus decreasing the displacement. I can conceive that in a vessel of very short length this action would take place; but in a long vessel, it seems to me the effect of this upward action would be to raise the stern of the vessel and lower the bow, the center of gravity of the vessel acting as a fulcrum for the moment of the applied force at the stern of the vessel. If this action would take place, practically the effect would be one disastrous to the efficiency which Mr. Root claims to have obtained. Mr. Root's method of propulsion might still be more efficient in case his theory of impact of the propeller in the water is correct; but, certainly, the action I have pointed out would detract from its value. This action would not take place if it were considered that the vessel were to be lifted bodily; but when we consider the length of a vessel to be, say, three to five hundred feet, I think we will have to concede that the effect of this force applied at an angle, say, of 60 degrees, lifting the stern, would have the effect of lowering the bow proportionally—either exactly the same or to a certain extent—which would make the general effect worse than if there was no difference in the displacement between the old and the proposed method of propulsion.

Relative to Mr. Emery's remarks as to the motion of the wedge, certainly the motion of the weight might be a greater distance longitudinally or horizontally than the motion of the wedge applied at an angle; but the weight displaced by this wedge with the velocity with which it is displaced, could under no consideration be greater than the force into the velocity with which it is applied. Therefore, while the motion of that piece which is moved by the wedge horizontally might be greater than the motion of the wedge, the total amount of momentum given out could, under no consideration, be greater than the momentum applied. Therefore the illustration which Mr. Emery has taken does not at all substantiate any statement that the actual speed of the vessel would be greater than the speed of the screw, because in that case we have the power into the speed of the screw as one of the forces. Now, if the speed of the vessel becomes greater, it can only become so by increasing the force applied; and since the force applied is a constant quantity in this case, the speed of the vessel could not possibly be greater than the speed of the screw.

Relative to the question of the impulse of the wind upon an ice boat, the reason that the ice boat goes faster than the velocity of the wind is the following: The component of the wind pressure at any time in the direction of the propulsion of the ice-boat is certainly less than the velocity of the wind, but the effect is cumulative. The wind strikes at an angle, and causes a motion horizontally which it retains. Now, the next line of wind strikes upon that, and so the cumulative effect of these different impinging strata or planes of air upon the ship causes the ship to go at a faster rate than the wind itself. If, however, we were to assume the wind to be one constant quantity, giving the impulse for one moment, then the vessel could, under no consideration, go faster than the velocity of the wind. We cannot get more momentum out of a thing than we put in it; we may get a less actual useful result, because a certain amount may be consumed in friction, but we cannot get more. If Mr. Root tells us that he has obtained a greater speed than the speed of the screw, of course we do not know how far the experiments were entirely correct, but they certainly call for consideration and investigation. All I wanted to point out here was that Mr. Emery's illustration would not account for that; and, indeed, I do not see how it could be accounted for at all, if our ideas of force and the effect of force are to hold true.

MR. ROOT.—I am glad the gentleman has made his remarks. The paper that I have read I suppose will be published, and be brought before the engineers of the highest ability in this society, and also of the world. I am entirely willing that it shall stand or fall upon its merits. If there is anything wrong in the theory, anything that does not conform to the absolute results that can be obtained by experiment, I do not want it to pass; I want it to be brought out and be shown.

As to the point of which the gentleman spoke as to the raising of the stern of the boat, those who have given any attention to the subject, know that a boat, when it is going through the water, tends to rise out of the water at the bow. As you crowd the boat along, it naturally tends to rise up and skim over the surface. I read an account of a boat that was built by the Rothschilds', where there was an immense amount of power put into a small compass, just to see how much speed could be got. Her screw was a horizontal one. That boat rose out of the water one-third of her whole length when she was being driven at a speed of twenty odd miles an hour. The boat was built here at Greenpoint, and, I believe, was on exhibition at Philadelphia, at the time of the Centennial. That would sink down in the stern (so I understood from those who operated her) so that you could not see a person sitting in the stern of the boat; it would drop right down in the trough. It seems to me that this lifting action at the stern is the very thing we want. The trouble, when we give force to a boat, is to keep her up at the stern.

There is another great advantage which will be found, if this thing is ever practically applied, and that is in the length of the shaft between the engine and the screw. In all our large ships the shaft-alley runs from the engine back to the screw—in some ships a distance of two or three hundred feet. That alley has to be kept open to get at the bearings of the shaft. The shaft is sometimes broken; it seems to me that is a very weak point in all vessels. By this application you place the engine right over the dead-wood in the stern of the ship, put the wheel right down where it is now, and a shaft twenty feet long, with the engine on one end and propeller on the other, does the business. That is very different from three or four or half a dozen lengths of this enormous shaft, two or three hundred feet long, going through the channel clear under the cargo.

As to other points in the application of this—of course, in regard to the application of the power and the modeling of the ship and so on, that calls for a change; if this thing is correct and practical, I look to the time when these changes will come about. I believe the thing to be right, and I offer it to any criticism that keeps within facts and within things that can be demonstrated.

MR. CHAS. T. PORTER.—I am very much disappointed in this paper of Mr. Root's. It is a very different paper from what I expected to listen to, from the conversation which I had with him yesterday.

An inventor comes before this society claiming to have made a discovery which is of a totally revolutionary character; he reads a long paper on the subject, and he does not give us one solitary fact. Now, what have we got to talk about? Nothing! I do not see, in the absence of facts, there is anything to consider. If Mr. Root had stated that he had obtained such and such results, with a certain expenditure of power by a horizontal propeller, and certain other results by a certain expenditure of power and with a different propeller, and had stated the precise conditions under which those experiments were conducted, and they seemed to be conducted fairly, and really presented something practical—a result that somebody had got to explain on some theory or other—that would be something. But what have we got? Nothing at all, except the fact that Mr. Emery has given an opinion.

There are some principles supposed to be established in respect to screw propulsion which I understand Mr. Root to deny. In support of this, we have his authority, with the authority of Mr. Burgh, if I understood him correctly.

MR. ROOT.—Mr. President, I do not think the gentleman could have heard the paper read; I think he must have come in since. I stated as a fact that the speed of the boat was greater than the pitch of the screw multiplied by the number of its revolutions, and I believe I gave the comparison on the paper. I also stated, as a fact, that there was such a thing as the constant velocity of water through a screw propeller that reduced the amount of thrust, as heretofore computed. And from these two facts I went on to account for the results produced, and proved them mathematically—that is, demonstrated them to the best of my ability. But I advanced these things as facts, and I advanced it as a fact that the experiments were made and the results produced; not only that, but I can verify it by proof. I am a private individual; I have not the time or money to go on and get actual results that will bear to be put before the public, as results could be put before them if experiments were instituted by the Navy Department, by the Stevens Institute, or by some person of immense wealth, who could go on and carry these things through, and get all the data in the most particular and precise manner. But I have made certain experiments, which have cost me, I suppose, three or four thousand dollars, during the last two or three years, and I have produced certain results. I have advanced these things as facts, and endeavored to demonstrate why they are so. If the gentleman does not comprehend that he doesn't comprehend anything I say.

PROF. ROBINSON.—I understand that there have been facts presented here that are valuable—one in particular of great value; that is, Mr. Root had obtained a greater speed of vessel than the pitch of the screw multiplied by the velocity would account for. It strikes me that that is possible with this screw, and, in fact, inevitable, unless you consider the resistance of the boat as too great to make this admissible. The theoretical velocity of the boat from this position of the screw would necessarily be one greater than the pitch multiplied by the velocity. The only reason why it should not be greater than that is that the resistance of the boat is such as to make such an amount of slip, that the actual velocity could not come up to the theoretical velocity so nearly as to equal the velocity multiplied by the pitch. The question of speed of the boat is one of velocity and not of force; that is, considering the motion itself. The motion of the boat theoretically would be the component which corresponds with the component of velocity instead of the component of force, and we should distinguish between components of velocity and components of force. The resolved component of velocity would be necessarily greater than the velocity of pitch multiplied by velocity. We might have such a resistance of the boat that the boat would have an actual speed as far as pointing to pitch and velocity, but if you take away that pitch, then the boat may go on with higher velocity, and reach a velocity greater than the velocity accounted for by the pitch and velocity of the screw.

I think the iceboat analogy is a good one, and, in considering it in connection with that, we should consider the question only of velocity, and not of force. The only difference between this and the iceboat, it seems to me, is that the fluid, in the case of the iceboat, is active, instead of passive. In this case it is passive, and not active. The propeller float is active, and in the iceboat the sail is passive; but, as to velocity, the question is one and the same. The velocity of the iceboat is merely the velocity of the wind, and the same diagram for the iceboat would necessarily bring out a greater theoretical velocity than the velocity of the wind. I should consider the same true here, and agree with Mr. Emery and Mr. Root.

As to the elevation of the stern of the boat, I think that it is considered desirable by boat engineers that the boat should stand with the prow a little higher than the stern; for beauty's sake, gracefulness, etc., the boat should not appear to be running its nose into the water. If the screw should be placed a little further ahead than the usual position of it, the tendency would be to lift the whole boat, which would not be objectionable at all very likely, because we could lift it so as to make a mere streak on the surface of the water. If it is a fact that the prow of the boat is so much raised, this may be the very thing needed to bring the boat in a desirable position.

MR. OBERLIN SMITH.—I do not see why experts, or any one else, could doubt the possibility of the speed of the boat being faster than the pitch of the screw, providing the screw is inclined, as in this case, any more than that you can change the amount of motion in any mechanism by applying power to an inclined plane by levers at different points. After all, the power obtained is merely the product of the velocity and force. I am inclined to differ with Mr. Root as to the theoretical advantage of applying the force in that direction. It seems to me there is neither loss nor gain in that. I do not dispute his facts. With regard to the practical advantage, I think it is due from another cause—pushing the water downward. If that is the case, the same advantage could be secured by putting the ordinary horizontal screw in a lower position. Of course, it is impracticable to put it far below the keel. This may be an advantage on that account. It affords deeper water where there is less opportunity for it to be churned up. The same advantage occurs with the inclined

screw at the bow that Mr. Root has experimented upon; but I think that the inclined screw at the side of the vessel, at the same height as the ordinary horizontal screw, would show no advantage. It seems to me that the advantage, if there is any shown by Mr. Root's experiment, is not inclining the screw; it is in the acting upon deeper water. I do not see why putting a greater force with less velocity, or a less force with greater velocity, should make any difference in the matter. We all know that screw propellers waste a great deal of power in churning the water and throwing it in the wrong direction. The only theoretically perfect propeller in a mobile substance like water would be an endless chain, carrying floats standing perpendicular to the line of motion. As long as we cannot get any theoretically perfect push upon the water, this is all a matter of experiment. This screw may, for the reason before stated, be better than a horizontal screw. I hope it is. With regard to lifting the vessel, it seems to me that is a mere matter of ballast. As to the advantage spoken of in practical construction, I should think it would be a good thing.

MR. CHAS. T. PORTER.—In order to show, gentlemen, that we are talking without having anything to talk about, I will state the circumstances and the conditions of Mr. Root's experiment, as he related them to me yesterday. He applies his screw at the angle of 60° from the horizontal, as stated by him, between the two halves of a catamaran boat at a point somewhere back of the middle of the boat. The effect of this application of force is to lift the boat one-tenth of its displacement out of water.

The lifting force being applied behind the center of gravity of the boat lifts the stern more than it does the bow, and the center of gravity falls in front of its center of suspension, and it slides down hill in still water. That strikes my mind as being probably the philosophy of the thing, when you get the facts of the case. But, excepting only the angle, they have been withheld; they do not appear in Mr. Root's paper. I have communicated them precisely as Mr. Root stated them to me yesterday. Well, you could not apply a screw in that way to the stern of a steam vessel, it seems to me; at any rate, we have not had one so applied. We have got an experiment tried under certain conditions, and, of course, those all ought to be spread before us.

MR. DENTON.—We know that negative slips have been recorded by a number of active experiments, extending through a long series of years.

We have had a number of explanations of that, all of which allow of some action of the water as a fluid, which may be caused by the motion in that fluid, independent of that put upon it by the steam that supplies the motion to the propeller. The ice boat has been cited as an illustration of this fact. There we have a number of planes, and we draw upon no plane of the wind for the full energy; we get a portion of the energy in one current, and that starts the boat; and then we get another impulse, and so on. We draw upon the energy as a total, but never upon the total energy of any one plane. We cannot have by any resolution of force more energy in the steam than there is in the direction of the line of the shaft itself. That is what is called for if we drive the ship faster, because we throw off all questions of any action of the water, independent of the energy that comes from the boiler. We cannot have more than a constant amount of energy developed by that screw; we cannot have the speed greater, or the force greater, without having more energy in the steam. I think Mr. Porter's position is the right one. The only new fact that is brought forward in this paper I think, is that we have the negative slip problem arranged in a new way.

MR. WOLFF.—Prof. Robinson, in his discussion here of the resolution of the velocities, has entirely left out of consideration the mechanical problem before us. The problem has been stated very clearly by Mr. Denton. We have a certain power, and that has to do a certain amount of work. We cannot possibly increase the speed, providing the power remains the same. Mr. Denton has put this forward so clearly, that I do not feel called upon to do it again; but I thought that I would like to endorse Mr. Denton's remarks upon this subject, and bring out more clearly that I had those in view when I made my previous remarks.

PROF. SWEET.—I should like those who believe in the theory of negative slip, to take this into consideration: Supposing all the power to be consumed in rubbing the water into motion, and all this motion to be concentrated in a cylinder in the rear of the vessel, of exactly the same diameter as the diameter of the screw. If the power of the screw is lost in putting the vessel in motion, then where comes in your negative slip?

MR. CHAS. T. PORTER.—I do not want Mr. Root to imagine that the sharp language that I, perhaps, used, is dictated by anything except a desire to get hold of the facts of the case, all of them. I think talk is wasted until we have them before us. Now, it may be that this is really a great discovery of Mr. Root's. If we rely upon gravity to move a vessel, and merely apply ourselves to lifting the stern of the vessel so that gravity will propel it, it may be something worth while to do; but that a screw exerts a force in any other direction except on the line of its axis, is quite too preposterous in my judgment, to be credited for an instant. It would seem that in this case the action of the screw lifts the stern of the vessel, and gravity carries it forward, and by that means the screw may be applied more advantageously. I submit that Mr. Root did not present anything of the kind in his paper, and avoided all the facts that would enable him to form a theory. I merely wanted to express my disappointment that the facts of the case were not presented.

MR. ROOT.—I think the gentlemen have misapprehended some of the points in the paper that they will see when they come to read the thing over. With regard to the doubt as to the gain which can be produced, I will just say one word. The way that I account for the gain is this: We all know that a screw propeller is something that is anywhere between a revolving disc and a revolving paddle. If you keep increasing the pitch until you bring the pitch around on the line of the axis of the screw, you have got a paddle wheel. If you bring it around at right angles to the curve, you have got a disc. Anywhere between these two points you have got side action. That side action is a dead loss, so far as creating any thrust in the line of the axis is concerned. The nearer you approach to the paddle wheel the more side action you get; and, as you incline the blades of that paddle, converting it into a scew, it must move the vessel ahead. If your pitch is slightly inclined from the paddle, then nearly all your power is given to whirling the water around, and very little of it to pushing your boat ahead; if you turn your blades around still more, then you give more power to pushing your boat ahead and less to revolving the water around, and so you can go on until you reach a point where the amount of power which is consumed in whirling the water around is counterbalanced by the friction of the blades and the thickness of the blades. Now, that is the point at which you will stop and reduce your pitch. That point has been found by experience, I think, to be one and a half diameters of pitch; that is, with a four-blade screw, you would get a six-foot pitch. All I claim is this, that, with a horizontal screw, when you give it one and a half diameters of pitch, properly applied to the vessel, it is working in the best form for the horizontal screw, and you would get the best result from it. Now, if we can find any way by which we can reduce the side action of that screw, without increasing these losses that occur from friction and from thickness of blade, why, then, we will get a positive gain. I claim that, by inciining the angle of the shaft, you virtually increase the pitch of the screw. Between a screw of one and one-half diameters of pitch and a screw of one-half that pitch, say, three quarters of one diameter, I have made a comparison, which shows the theoretical gain to be thirty-one per cent. That is thirty-seven per cent. in favor of the screw with the least pitch, provided you can apply the screw so as not to have that loss offset by increased friction. I say, by inclining the angle of the shaft, you do that very thing. You get less loss by side action, without increasing very materially your loss from the frictional surface and thickness of the blade. Those two losses increasing as the square of the velocity, of course increase very fast when you get to that point. I claim that you can reduce the pitch very materially.

PROF. ROBINSON.—I do not disagree with Mr. Wolff in the matter of energy. I know it will take the same amount of energy to propel a boat with one screw or another. I did not touch upon that point; I rather avoided it by saying that it is a question of speed rather than one of velocity. The possibilities of this may be such that we may yet see boats flying through the water with nothing but the screw touching the water.

MR. F. B. ALLEN.—It seems to me that there will be a most useful effect in the elevation of the stern and depression of the bow. As I understand it, the propeller shaft, applied, as it is, in an angular direction, necessitates the employment of gearing. The engines being bolted to the kelson in the usual way that will bring in an additional loss and some practical difficulty. It seems to me that these are practical considerations that are worthy of our attention.

MR. COTTER.—I entirely agree with Mr. Porter in this matter. We have nothing to talk about here. We are asked to accept a theory. If Mr. Root will be kind enough to tell us how much coal he ran a given distance with, with a given displacement, with a given pressure on his engine, with his improved screw, then we will have something to talk about and something to find out how he did it.

MR. ROOT.—The gentlemen can figure up for themselves how much coal it is going to take.

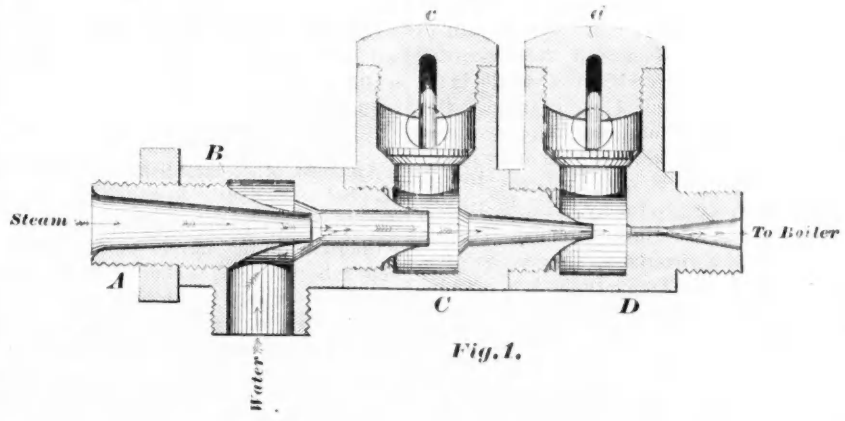


Fig. 1.

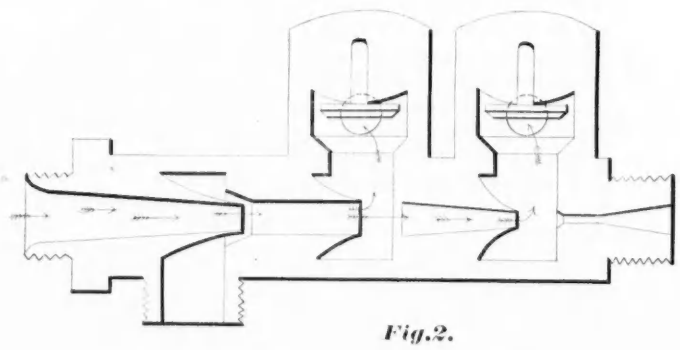


Fig. 2.

A New Injector.

In the accompanying engravings Fig. 1 is a longitudinal and Fig. 2 an outline section of a feed-water injector, recently brought out by Loftus & Kinnear, Albany, N. Y. Referring to Fig. 1, it will be seen that this injector consists of three sections, *B*, *C* and *D*, to the first of which is attached the adjustable nipple *A*, adapted to receive the steam pipe. This nipple is provided with a coniform passage, which is, as will be seen, of the largest diameter towards the entering steam, while the metal surrounding the inner part is brought to a thin edge. The engraving clearly points out the character of the continued passage of the steam and water-way through the sections to *D*, where it ends in a conical-shaped passage, the larger diameter of which is towards the boiler. In section *B* is the induction, or water branch, terminating in a suction chamber surrounding the end of the passage through the nipple.

Section *C* is provided with a vacuum chamber, connected with the suction chamber just referred to, by a direct, uniform cylindrical passage, and immediately over which is situated a valve chamber provided with a small valve. A similarly-constructed chamber, etc., is situated in section *D*.

It will be noticed that the nozzle *A* passes entirely across the suction chamber and enters the conical enlargement of the passage in *B*, in such a manner as to form an annular way, which may be contracted or enlarged by screwing the adjustable nozzle in or out.

The operation of this injector is as follows: Steam being admitted, passes freely out of the escape opening in section *C*, as indicated in Fig. 2 by the direction of the arrows. The flow of the steam, being practically unrestricted, attains a velocity sufficient to create a vacuum in the suction chamber, by which the water is caused to rise in the induction pipe, and entering the passage it meets the incoming steam and condenses enough of it to form a vacuum in the chamber of section *C*, and to close the relief valve over that chamber, previous to which the water has attained sufficient velocity to have established the current, through the injector to the boiler. It will be seen that the novel feature in this injector is the cylindrical passage in section *B*, and vacuum chamber in section *C*, with the auxiliary relief valve, by which means it is said the steam is provided with an unrestricted passage out of the relief valve, not provided in other machines of this class, and which materially assists in its working with certainty through a great range of pressures.

This auxiliary valve, of course, is in addition to the regular relief valve shown in section *D*.

The Chicago Tariff Convention.

A large and influential tariff convention was held in Chicago, Nov. 16th and 17th. Speeches were made by several gentlemen, and the following committee on a Permanent Industrial Western League was appointed: O. W. Potter, A. W. Kingsland, C. W. Smith and A. N. Carpenter, of Chicago; Homer Hamilton, of Youngstown, Ohio; J. Whittier, of Michigan; and Chas. Ridgely, of Springfield, Ill. A committee of five was also appointed (headed by John Roach) to visit Washington and present the acts of the Convention to the proper committees of both Houses, and forward its objects in the proper ways.

Among the resolutions adopted was one pointing out needful action by Congress in building up the American shipping interests. It reads as follows:

Second.—They should make American vessels the carriers of American mail, at rates proportionate to the value of the service performed, without regard to the rates at which foreign vessels, subsidized by their own governments, may be willing to carry them.

This is exactly in accordance with the plan suggested by us some months ago, and we hope to see it adopted. We should have no subsidies, but a fair discrimination in favor of American shipping.

The time for closing the American Institute Fair has been extended to December 3d.

The manufacture of drop-forged tools is an industry now driven by the demands of trade far beyond any limit heretofore reached in this country. It is almost impossible for buyers to get their wants supplied within what to them seems a reasonable time. Most of them have to wait patiently for weeks or months to obtain what they order.

We have received a paper by Prof. W. D. Marks, reprinted from the *Franklin Institute Journal*, entitled "Necessity of Clear Mechanical Conceptions." It is so well interlarded with algebraic formulæ that we are constrained to suggest to the professor that he write a sequel on the "Necessity of Clear Mathematical Conceptions."

We have received from the United States News Company a copy of Vennor's Almanac and Weather Record for 1882. It is an 80 page pamphlet, and gives (in addition to a portrait of the author) predictions of almost every kind of weather that could be desired or dreaded. Speaking of December, 1881, he says: "I hardly like the look of this month, viewed from the present standpoint (September 18). It looks ugly and smacks of cold, bitter, biting cold, north and south, east and west, but with sparsely snow-covered ground in northern New York and Canada, and bare ground west and south."

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NEW YORK, DECEMBER 3, 1881.

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The printed date on each wrapper shows the time to which the subscription is paid. We discontinue the paper in all cases when the time paid for has expired, unless renewed.

Beginning our Fifth Year.

This issue of the AMERICAN MACHINIST begins its fifth year of publication, although our present volume closes with the issue of December 31, 1881. In calling attention to our own progress, we are prompted to go back four years, and reproduce a portion of the "Introductory" from our first issue, dated November, 1877. At that time we said:

"With the best facilities at our command, we propose to make this the standard machinery newspaper of America. * * * * The present seems peculiarly a fitting period to start out upon the territory of enterprise we have chosen, for indications are strong and positive that the fog which has for four long years enveloped the commercial progress of our country is about to lift—slowly it may be, but surely. Already light begins to dawn, and the full sunshine of business prosperity will show *a development of American machinery, such as the world has never before witnessed.* The genius that has distanced the Old World in useful mechanical inventions, will brighten still more under influence of auspicious times, and rapid improvements will be wrought, the adoption of which will leave far behind those who cling to old ways and processes."

When we wrote the above the machinery business throughout this country was in a state of extreme depression, but our readers, one and all, will bear witness that we made no mistake in our undertaking or in our predictions, as then set forth. The growth in circulation and influence of the AMERICAN MACHINIST has been without a parallel in the history of mechanical publications. Our subscribers are found not only scattered throughout every State and Territory of the Union and Canada, but in Great Britain (largely), France, Germany, Austria, Russia, Spain, Italy, Belgium, Holland, Turkey, Roumania, Switzerland, Greece, Sweden, Australia, China, Japan, India, Africa, Cuba, Mexico, South America, and other foreign countries.

The future of the AMERICAN MACHINIST can only be predicted by reference to the past. We shall make improvements from time to time, but as our readers well know, they are not heralded in advance of their arrival. Our policy is to make very few promises and to faithfully observe all those we do make. With thanks for the generous support and encouragement always accorded to us by the mechanical community in the past, we go forward with a strong determination to merit an increase of the same in the future.

Importing Machine Tools.

We have at different times had occasion to refer to the fact that in many instances our machine shops were unable to supply the demands for their products in what seemed to the purchaser a reasonable time. It was quite generally believed two years ago that before this time such a condition would have ceased to exist; but, so far from this being the case, the condition—notably in the instance of machine tools—is rather aggravated than otherwise, and this notwithstanding the fact that nearly all old concerns have largely increased their output, and many new ones have been established.

Within the past week we have observed that one large firm near this city is importing a large slotting machine, much against their inclination, we are informed, and simply because they could not contract for it in this country to be delivered in less time than from eight to twelve months.

The demand for steam engines and locomotives is hardly less pressing. How long this is to go on cannot be foreseen; but with the opening up, as it were, a new section to mechanical pursuits (we refer to the South), and with the demand brought about by the rapid progress of electric lighting, as well as the demands incident to a state of general industrial prosperity, there is no reason to look for a materially different state of affairs for some time to come.

In our last issue we published in full a somewhat lengthy paper, on "An Improved Method of Screw Propulsion," read by John B. Root, at the last meeting of the American Society of Mechanical Engineers. The reading of the paper was followed by a sharp and animated discussion, which, in this issue, we give another large portion of our space to present in full, as reported by our stenographer.

There is a considerable loss of power in screw propellers as ordinarily used, and if some satisfactory method can be devised to reduce this loss to a minimum, the man who discovers and demonstrates the improvement will be entitled to the highest consideration not only of engineers but of the whole people of every civilized nation.

We publish this week the first of a series of letters from the Atlanta Cotton Exposition, by C. J. H. Woodbury, of Boston, and will present the second letter in our next issue, describing some of the principal exhibits. We also show a plan of the buildings and grounds, with each building designated, so that by its aid a visitor can find his way to any desired part of the exhibition. Since the South has turned its attention quite earnestly to manufacturing, that section of our country has become a valuable locality in which to sell machinery and mechanical appliances. After leaving Atlanta, Ga., Mr. Woodbury will travel through some of the other Southern States, with a special view to noting the resources of the country, and will tell the readers of the AMERICAN MACHINIST, while on the way, something that cannot fail to interest them.

Amongst other establishments that have adopted "Sackett's systems of working drawings," as explained and illustrated by "Chordal" in the AMERICAN MACHINIST of September 10, 1881, is that of E. W. Bliss, Brooklyn, N. Y., Mr. Jordan, the Superintendent, having procured 250 cards with which to make the experiment, and being, as we are informed by him, much pleased with the plan. He has changed the size to what seemed a better one to him, having his cards made 14″×20″, instead of 10″×13″, as used by "Sackett." We have seen one of these drawings finished and labeled, and can say that it presents a very neat and serviceable appearance—even better than it promised as illustrated.

Our issue of September 24, 1881, contained an engraving of Capt. John Ericsson's torpedo-boat, the Destroyer, together with detail engravings of his system of torpedo warfare, both in its application to the Destroyer and to ordinary steam vessels, that by this means are converted into effective vessels for both attack and defence. An exhibition of the Destroyer was recently made at the Hoboken wharf in the presence of Gen. Grant, Secretary Hunt, and other distinguished gentlemen. The exhibition was made by the Delamater Iron Works, who constructed the vessel for Capt. Ericsson. In the trial, an uncharged projectile, 25 feet and 6 inches in length, was discharged by 12 pounds of giant powder, striking a target placed at a distance of 300 feet. The muzzle of the gun was 6 feet and 6 inches under water; the projectile passed through the target 5 feet under water, and appeared on the surface 100 feet further on, passing through the distance of 400 feet in three seconds, under the impulse of what will be seen to be a very light charge of powder. The experiment was pronounced an unqualified success by eminent naval officers and engineers present, including many who have all along doubted its success.

Forgings at the Fair of the American Institute.

Many of our readers have doubtless noticed at the fair of the American Institute some fine specimens of forging from the Continental Iron Works, Brooklyn, N. Y. One of these—a floating torpedo, stripped of its attachments—is a hollow sphere nearly three feet in diameter, with a radial flange extending entirely around it, as if made in halves to bolt together. It is, however, in one piece, without openings, except such as are made for purposes that have no connection with the process of forging. It is made of steel $\frac{5}{16}$″ thick all over, and the one on exhibition, while apparently neither better nor worse than many others made at the Works, is a remarkably fine specimen of hydraulic forging.

As indicated by the flange, it is made in two pieces, which after being properly formed are welded together. The piece which is to form one-half of the shell is first subjected to a blow, or rather a pressure from a hydraulic ram, having a cylinder 16″ in diameter, and working under a pressure of 1,500 pounds to the square inch. This is simply one step towards bringing it to the required shape, and results in bulging it out at the center and towards the edges, and indicating the boundary of the flange. It is then heated in a gas furnace, again placed in the press and over the ram from which it receives another blow—the second in the process of formation. It is then reheated, again subjected to the 150-ton pressure, when it assumes the form of a hemisphere, having a projecting flange quite fair and even.

Of course, during this operation suitably formed dies are used, and the fact that these dies are turned and finished quite smoothly accounts, to some extent, for the smoothness of the forging.

In forming the hemisphere it is obvious that some means must be employed for holding and bringing the flange to the required shape. To accomplish this, four cylinders, each 8″ in diameter, are mounted on the top and at the four corners of the housing of the press. The combined areas of these four cylinders, as will be seen, are just equal to the area of the single cylinder situated below or at the bottom of the press. The rams of these four cylinders are connected to a massive ring, which can thus be forced down upon the flange with a pressure equal to the upward pressure of the ram of the large cylinder. In this way, when the hemisphere is finished, the flange is also brought to the proper condition.

After some minor parts (having reference to the attached pieces) have been added, the flanges of the two pieces, which together are to make the completed shell, are placed fairly together and heated in a specially constructed furnace, arranged to allow a portion of the two flanges to be exposed to the heat, the shell being so mounted as to be revolved in a way to bring all parts of the flange in succession to be heated.

The welding is done by what might be termed an exaggerated pair of pliers, between which the flanges are squeezed into welding contact, and at the same time their outside edges are neatly trimmed.

The water pressure is obtained from a Worthington duplex pump, which delivers into an accumulator, the pressure of which regulates the speed of the pump.

The other forgings, one of which has the appearance of an exaggerated bottle, about twenty inches in diameter and more than three feet high, and another, a hollow cylinder with closed ends and projecting trunnions, are simply fine examples of the skill of the mechanic in forging plate-metal work, being done, we understand, by the use of ordinary appliances.

Why are not Good Engineers Always Secured?

In endeavoring to answer the above question we will state first that many of the people employing engineers will not pay the price demanded by good engineers. When a person is under the necessity of putting in an engine and boiler, either to run an elevator or to furnish power for other miscellaneous work, the important questions arise: "Will I be required to hire an engineer?" and "Isn't there some way by which I can avoid paying out the amount required to hire an engineer?" There are many plans resorted to under these circumstances by persons who look upon the amount spent for engineers as money thrown away, and never consider the safety of their lives and prop-

erty. The person owning the engine and boiler goes to the inspector or examiner of engineers, and states his case. He is told that he is allowed to have a fireman, but either the proprietor or some one about the place must pass examination as engineer. The proprietor, who used to be around machinery somewhat, and understands a little about the management of steam, concludes to be examined; so he submits to being questioned by the examiner, who is very lenient (for reasons best known to those who have been there), and finally declares the gentleman proficient as an engineer. The certificate or license is made out, and a fireman hired at $1.25 or $1.50 per day. He receives a few instructions from his employer in regard to his duties, and is left with the injunction "that if any one calls to see the engineer, he (the employer) is to be called at once." Sometimes the fireman does not see his employer, the engineer, for a week at a time, so he is virtually the engineer in charge of the engine and boiler.

We have known men of this class who were fully competent to manage steam machinery, even more so than their employers, who had the license of an engineer; but such is not the case in the majority of instances.

In a shop not a thousand miles from this city, the boiler is in charge of a blacksmith's helper. One day he became very much confused by drinking too strong tea at dinner time. In the course of the afternoon one of the workmen in the shop discovered water flowing from the ash pit, which, upon examination, proved to come from one of the boiler seams. The gauge cocks were tried, and no water could be found. The result was that the fire had to be drawn, and the boiler makers had a job for a week in repairing the overheated boiler; the shop standing idle in the meantime. When all was ready to start the same man was again put in charge, with the injunction that he would be discharged at once if he ever became intoxicated again. The employer says John is a good fellow when he is sober, and he never got into difficulty before; when the real truth is John fills the place of engineer and runs an 80 H. P. engine at $1.50 per day. If a good, practical engineer was hired, he would have to be paid $2.50 to $3.00 per day.

A short time ago a firm advertised for an engineer, and amongst the other applicants for the situation a strictly first-class engineer answered the advertisement.

He was kept nearly three hours waiting in the office before he could see the employer, who did not seem to be uncommonly busy.

Just as the latter was ready to go home, he asked the engineer if he could run a lathe. The answer being in the affirmative, he was told that an engineer to fill the position in their concern "would be required to wheel his own coal and ashes, do his own firing and make his own repairs, not only upon the engine, but about the place at night and on Sundays, for which no extra time would be allowed. Besides this he was to run a lathe near the engine room door. To do all this would require the engineer to get to the place at 5.30 in the morning, and leave at 7 in the evening.

For all this service the sum of $10 per week was to be paid. If under these circumstances the engineer, being overcome by fatigue, had fallen asleep and an explosion had been the result, would he have been to blame? He would have had to shoulder all the blame.

A vender of patent damper regulators stepped into a factory not long since and solicited an order. The proprietor observed that it was no use to go into any expense in that direction, for, said he, "I recently bought a set of oil cups for my shafting, so that it would require little or no attention, except refilling the cups every two or three months. One day, upon inquiry, the engineer told me they had been taken off because they would not work, so I think that anything of a scientific nature is of small use, and the money expended for such things is worse than thrown away. The fact is, the fellow did not understand those cups, and his head was so thick that I could not beat it into him." This is the office side of the circumstance. Let us take a look at the engineer, who is paid the enormous salary of $9 a week, and is on the verge of quitting, because the manufacturer across the way has offered him $10 a week, and will have all his coal wheeled to the fire room. We find that he is expected to make himself generally useful about the place, and it is regarded as the least important of his duties to run the engine. It is the exception, when a competent engineer can be procured at such miserly pay. A mechanic in the shop has nothing to divert his mind from his work, and when his eight or ten hours work is done he goes home, while the engineer has a stuffing-box to pack, a joint to make in some pipe, flues to sweep, shafting to put up, and on Sunday, has to clean out the boiler, besides doing other work which must be attended to while there is no steam in the boiler. The only remedy for such practices is proper legislation and a strict enforcement of the laws. It has come to such a pass at the present day, that if a majority of the jury (in trying persons censured for boiler explosions either own or are interested in using steam boilers, the whole case is quietly dropped by unanimous consent (so said). On the other hand, owners of boilers are often censured for the carelessness or ignorance of their engineer, whom they hire to take care of their engine and boiler, and are required to suffer loss of money and reputation thereby. So long as gross corruption among those who are selected to administer the law is condoned by the public, so long we shall have boiler explosions in abundance, and other lamentable accidents attending the use of steam.

QUESTIONS & ANSWERS.

Under this head we propose to answer questions sent us, pertaining to our specialty, correctly, and according to common sense methods.

(1). D. B., Camden, N. Y., asks how the cams of a "Bliss" press are worked up to shape? *A.* Some of them are milled and others are turned.

(2). E. F. B., Du Bois, Pa., asks: What is a right hand lathe tool? Is it a tool that is fed towards the lathe head or not? *A.* A right hand lathe tool is one that is fed towards the head stock.

(3). A. M. W., Philadelphia, Pa., writes: Will you enlighten me a little? In your issue of Nov. 12, where does "Starting Bar" get 00269 no decimal point) for the density of steam; and further on where does he get the multiplier 64.3125. *A.* We presume by your noting the omission of a decimal point that you have discovered that the expression is .001269 which is the weight of a volume unit of steam as compared with water at an absolute pressure of 34 pounds per square inch; corresponding to a gauge pressure of a little less than 20 pounds. The weight of a cubic foot of sea water is 64.3125 pounds.

(4). W. Fitchburg, Mass., asks: 1. Is the strength of the current generated by a dynamo-electric machine exactly proportioned to the speed of the machine? *A.* No. It is more nearly proportioned to the square of the revolutions, but exactly how nearly is probably not definitely known. (2). Is it possible to measure the increase in the strength of the current when the speed of the machine is increased, say, by five revolutions? *A.* If the machine were working through a constant resistance it is probable the difference due to five revolutions could be detected—possibly measured—but working through lamps the changes in current, due to slight irregularities in the light, would be so much greater than that due to a difference of five revolutions, that this difference could not be detected—at least not measured. 3. What instrument is the most practical for measuring the strength of electric currents? *A.* Wheatstone's bridge.

(5). G. C. S., Brooklyn, N. Y., asks: Will you inform me if cigarette smoking is more injurious than cigars or a pipe? Some say that the paper contains arsenic; others that the paper in burning produces oil of creosote &c., &c. If you will give me the facts you will greatly oblige. *A.* It is generally conceded that paper cigarettes are much more injurious to those who use them than either cigars or a pipe, and substantially for the reasons you have quoted.

(6). J. F. R., Angelica, N. Y, writes us a long letter to the effect that he is 25 years old and very much dissatisfied with his present vocation which is that of a clerk. He has a strong inclination in a mechanical and engineering direction, and asks our advice with reference to pursuing a course of study to that end, supporting himself meantime by working as at present. *A.* We advise that plan by all means. After hard study for a year or two you will be more able than at present to understand your wants. In the meantime you ought to save some money to help you along at first, and you can then enter at the bottom and work your way up. Hard work is the only way to become an engineer, and you can no more assume the duties without preparation than an engineer can assume—for instance—your duties.

(7). H. L., San Francisco, Cal., writes; I would like you to tell me the proper load for 10″x 20″ engine with variable cut-off, running at 275 feet piston speed? *A.* you neglect to state the boiler pressure, but assuming it to be from 70 to 80 pounds, if the ports are well proportioned, such an engine should work at good economy with a mean effective pressure of 35 pounds. The mean net area of piston (deducting for the piston rod) may be taken at 77″; hence the indicated horse power will be

$$\frac{77 \times 35 \times 275}{33000} = 22 + \text{horse power.}$$

(8) J. H. H., Brantford, Ont., writes: You would greatly oblige by informing me through your valuable paper, how it is that in reaming a hole in the lathe with a fluted reamer, having a dog attached to the shank, resting on tool fastened in tool post, that by changing position of the dog on the shank it will affect the size of the hole reamed? As we do considerable of this kind of work, we have frequently noticed it, and as the reamer is perfectly true, I am at a loss how to account for it. *A.* We infer that the dead center of the lathe is kept in the center of the reamer, and used to force it through the hole. If your reamer is, as you say, perfectly true, and if the teeth cut alike all around, it certainly will make no difference where your dog is placed, with reference to the revolution of the reamer, provided it is always the same distance from the end. It is not possible to ream any number of holes of exactly the same size in the way you mention. It is nearly, or quite impossible, by the most careful means, to more than approximate uniformity of size by the use of a reamer, and in the means you employ you will see that the dog acts as a lever to crowd the reamer to one side of the hole, and that this crowding will be in proportion to the amount of metal to be cut, the quality as to hardness of the metal, and the feed of the reamer. If the teeth on one side of the reamer are sharper than those on the other side it will make a difference how the dog is placed. There is every reason why a reamer will not ream two holes of precisely the same size, more especially when used in a lathe as you use yours.

BUSINESS SPECIALS.

50 cts. a line for each insertion under this head.

An Otto Silent Gas Engine for sale; 7 H.P.; been in use 15 months, and can be delivered Dec. 1. Reason of sale: I am going to put in a larger engine of same make. H. W. Lyon, Bridgeport, Ct.

"How to Keep Boilers Clean," and other useful information for steam users and engineers. Sent free by the publisher, Jas. F. Hotchkiss, 84 John Street, N. Y.

Latest and best books on Steam Engineering. 3d stamp for Catalogue. F. Keppy, Bridgeport, Ct.

Presses & Dies. Ferracute Mach. Co., Bridgeton, N.J.

Foot Power Machinery, for workshop use, sent on trial if desired. W. F. & John Barnes, Rockford, Ill.

James W. See, Consulting Engineer, Hamilton, O.

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MANUFACTURES.

It is proposed to organize a company at Deadwood, Dakota, to build smelting works.

McDaniel and Harris are building a flouring mill at Knoxville, Tenn.

The Lake Flouring Mills, at Reno, Nev., which were recently burned, are to be immediately rebuilt.

Osgood & Barker, machinists and founders, Bellows Falls, Vt., whose foundry was recently destroyed by fire, will rebuild immediately.

W. H. Craig & Co., Lawrence, Mass., Manufacturers of Craig's Hydraulic Governor, are busy as usual, their shipments being to all parts of the United Sta .

The new works of the Lima Car Company, to be erected at Lima, O., will occupy fourteen acres of ground, and employ a capital of $250,000.

The Lewis Foundry and Machine Company, of Pittsburg, Pa., have a contract to furnish the Indianapolis Rolling Mill Company, with a full equipment of machinery for manufacturing steel rails.

The first blast furnace in Colorado was lighted at South Pue'blo, Sept. 7, and is at present turning out more than fifty tons of iron per day. The coal and ore is all mined in that State.

J. S. Graham & Co., Rochester, N. Y., employ 30 hands in the manufacture of wood-working machinery. Part of their shop is run night and day, and they are about two months behind their orders.

Bradley & Co., Syracuse, N. Y., are erecting a new storehouse, 80x174 feet, four stories high. They employ 170 hands, make one cushioned hammer a day, and have orders for forty hammers on the books.

The Belcher & Taylor Agricultural Tool Company, Chicopee, Mass., are building a large addition to their foundry, and will add new tools to their machine shop.

C. W. Le Count, South Norwalk, Conn., has just put in a new stationary steam engine and increased the capacity of his works so that he is now enabled to fill all orders for lathe dogs and tools.

No Fall trade has developed so far in the silk manufacture, and the Paterson, N. J. mills are somewhat dull at present. It is understood that the manufacture of plush and velvet is to be attempted once more in Paterson shortly; the machinery has just arrived from Europe.

The Cooper Manufacturing Co., Mt. Vernon, O., have recently been awarded a government contract for the metal work for eleven lighthouses for the Savannah River, Georgia and South Carolina. This, with their large number of orders for engines, will keep them very busy for some months.

Woodbury, Booth & Pryor, Rochester, N. Y., have 137 hands employed regularly until 9 o'clock every night. They are crowded with orders for engines, boilers, and machinery. One day last week we were shown through their shops, which are managed in as thorough and systematic manner as any we ever visited.

J. M. Jones & Co., who have been in the business of street car building almost as long as it has been a business—formerly at West Troy, N.Y., but more recently at Schenectady, N. Y.—are contemplating the enlargement of their works for the purpose of adding the building of passenger coaches to their present business.

The Continental Iron Works, Greenpoint, N. Y., are filling a government order for 200 ground torpedoes of the mushroom pattern. These are made of cast iron, and weigh about 1,500 pounds each. They are also making 180 floating torpedoes of steel; completing their contract from the Cunard Steamship Co. for machinery and iron work for their new pier, including eight double cylinder 8′x8′ hoisting engines; besides quite a variety of other work, including automatic beam engines, several boilers and tanks, elevator buckets, etc., etc. They are putting in new tools, and will soon put in one of their automatic engines to drive their machinery.

The Davidson Steam Pump Company, 41 Keap St., Brooklyn, N. Y., are adding new tools, including two horizontal boring mills. They succeeded in turning out 45 pumps last month—some of them quite large ones—and hope to increase to fifty a month soon. In addition to this, they have been obliged to get considerable heavy work done outside. They have a large force of pattern makers at work on their new designs and sizes of pumps. Advices from the parties for whom they furnished a two million gallon compound steam pump in September, are in every way satisfactory as to its economy and general behavior.

Newly Incorporated Companies.

NEW YORK.

The Waldron Engine and Pump Company, New York; Charles Wendell, Samuel R. Earls and Wm. H. Gray, corporators; Capital, $150,000. To manufacture steam engines, pumps and machinery.

The American Swedes Iron Company, New York; Chas. T. Raynolds, Henry K. Raynolds and Geo. W. Thompson, corporators; Capital, $150,000. For the manufacture and sale of iron and other metals.

The United States Underground Cable Company, New York; Adolpho Hegewisch, Jos. J. Slocum, Alfred Reichelt, Henry Allen Samuels and John K. Creevey, corporators; Capital, $600,000. To manufacture, lay and sell underground cables for the transmission of electric currents.

Three Cylinder Compound Steam Engine Company, New York; James W. Chisholm, James A. Hudson and Michael McMahon, corporators; Capital, $350,000. To manufacture and sell compound engines and parts thereof, and engines and parts of engines generally.

American Steam Motor Company, New York; Orazio Lugo, S. H. Olin and Geo. S. Evans, corporators; Capital, $50,000. To manufacture and sell steam and other motors and engines.

Lyons Manufacturing Company, Syracuse; Amy B. Lyons, Jay H. Wilbur, Nathan Baldwin, and others, corporators; Capital, $15,000. To manufacture and sell carriages.

The Huntington Water Meter Company, New York; Robert Fellows, Charles A. Cheever, Henry Hosford, James O. Hoyt and Louis C. Lewis, corporators; Capital, $500,000. To manufacture and sell water meters.

Machinists' and Engineers' Supplies.

NEW YORK, Nov. 17, 1881.

There is a dearth of new things, and manufacturers seem determined to let new inventions alone for the present, and run on regular lines of goods until the holidays.

Bolts and Nuts are very stiff, and prices, although unchanged, tend upward

The prices of Brass and Iron Fittings have been advanced from 7½ per cent. to 10 per cent., and all quotations have been withdrawn for the present.

Wrought Iron Pipe is the same as last reported, very hard to obtain; but the manufacturers seem to be just about holding their own.

A. Aller, 109 Liberty St., New York, is introducing a new Pressure Regulator for steam, water and gas, which is attracting considerable attention on account of its compactness.

Iron and Metal Review.

The demand for Pig Iron, although large and satisfactory, is not as extensive as it was a few weeks ago.

Prices, however, have generally tended upward, and remain unchanged. We quote as follows:

Foundry No. 1, $25 to $26; Foundry No. 2 X, $23 to $23.50; Gray Forge, $22.50. The demand for Foreign Iron continues equal to the supply, with prices as follows: Gartscherrie, $24.50 to $25; Coltness, $26; Glengarnock, $25; Carnbroe, $24 to $24.25; Eglinton, $23.

The active demand for Steel and Iron Rails continues with prices unchanged at $60 for Steel delivered next year and Iron at $48 to $50. The market for old rails is fair. We quote old T rails at $28.50 to $29 and Double Heads at $31.50 to $32. The demand for Wrought Iron Scrap is good, and the supply scarce. No. 1 is quoted $32.50 for prime selected from yard. The demand for manufactured iron continues as last reported, with sales large. Copper is in fair demand at 18¼c. for Lake Superior. Straits and Australian Tin, 21⅝c. to 22c.; and Billiton, 20⅜c. Lead, 5c. to 5¼c. Spelter, Western, and Silesian, 5¾c.; Antimony, 13c. for American and 14c. for Cookson.

WANTED

Wanted—A small second-hand metal planer; hand power. Address, J. E. Downes, Waterloo, N. Y.

Wanted.—A Second-hand Automatic Cut-off Engine, about 50 horse power. Must be in good condition. Send full details, with price, to Box One, AMERICAN MACHINIST, 96 Fulton St., N. Y.

Wanted.—"A young man, bright and active with three or four years' experience in machine drawing." Address, Box 5, Office of the AMERICAN MACHINIST.

Mechanical draughtsman and designer, scientific graduate, wishes position. Address Box 6, AMERICAN MACHINIST.

Wanted—Situation by a young man experienced in Tool making. Specialty of dies. Address, Box 3, AMERICAN MACHINIST, 96 Fulton Street, New York.

Wanted—Metal Pattern Makers and Brass Finishers. Fifteen Metal Pattern Makers wanted at once, those only who are accustomed to working on Steam and Water Work. Ten Brass finishers to work on Valve and Cock Work. Good Wages will be paid and permanent employment given to skillful, steady and industrious men. Apply, in person or by mail, to The Joel Hayden Brass Co., Lorain, Ohio.

A thoroughly competent and experienced steam engineer wants a situation of responsibility, with compensation corresponding to the degree of service rendered. Can furnish every required evidence of ability and reliability. Address, "Chief Engineer," office AMERICAN MACHINIST.

A Marine Chief Engineer, of an extensive experience, wishes a situation to run an engine, or take charge of the steam heating apparatus of a building. Is capable of handling all kinds of steam apparatus and do his own repairs. Best of references. Address R. L., Box 12, Office AMERICAN MACHINIST, 96 Fulton Street, New York.

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AND
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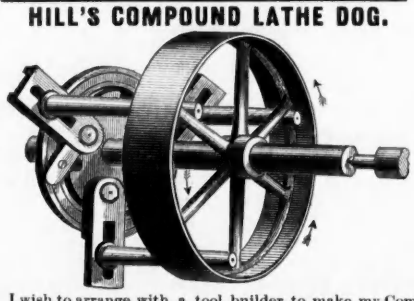
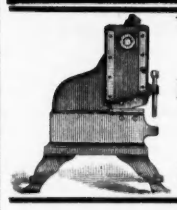
HILL'S COMPOUND LATHE DOG.



I wish to arrange with a tool builder to make my Compound Lathe Dogs, for turning pulleys in Engine Lathes—equalizing and distributing solid driving, just under the pulley rim. Unequalled and simple. Cuts and descriptions on application. **John Hill, M.E.**, Columbus, Ga.



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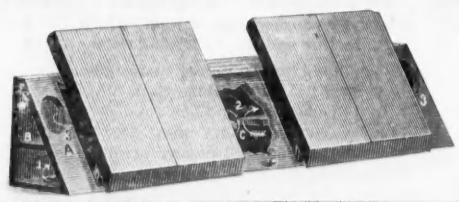

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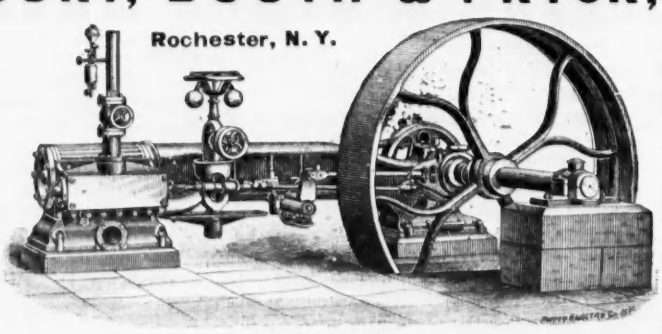

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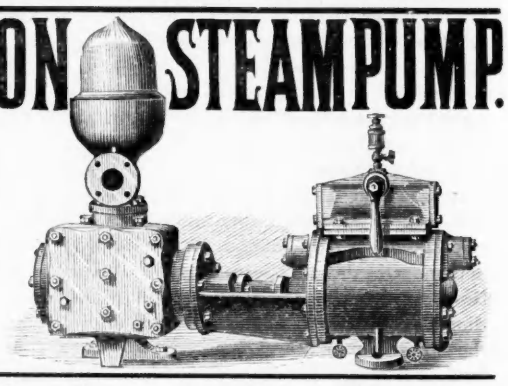

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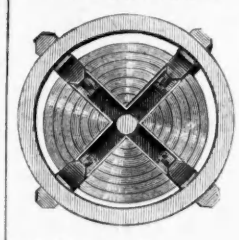

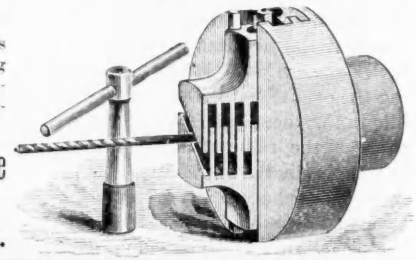

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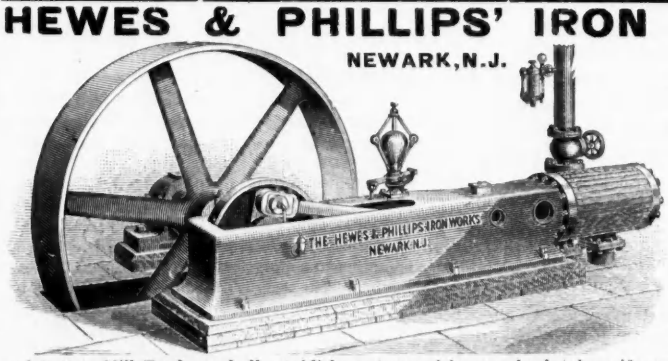

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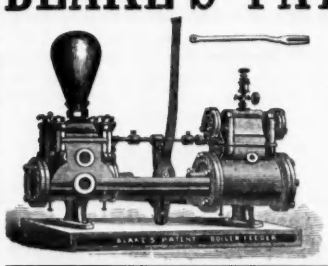

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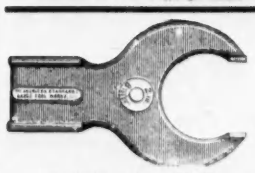

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